# SCIENTIFIC AMERICAN

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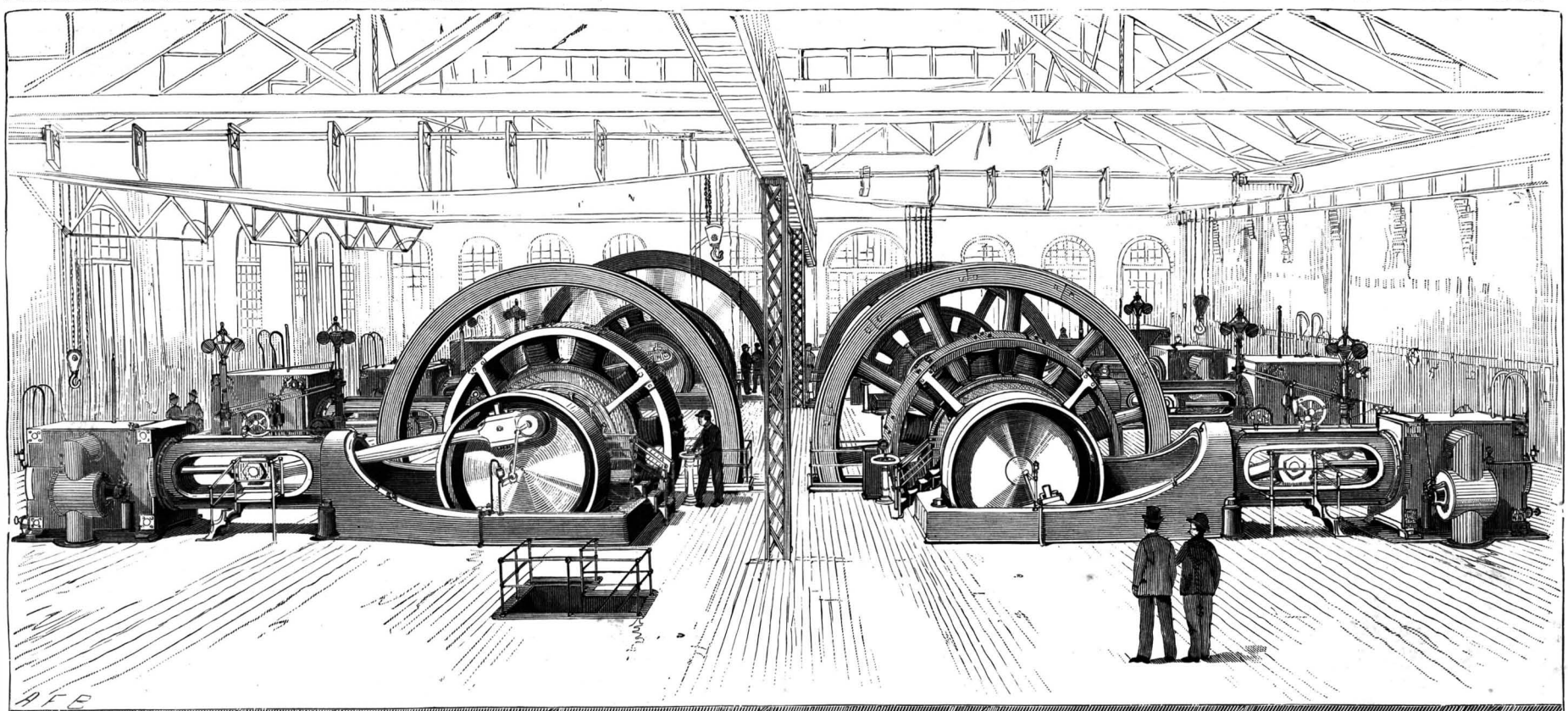
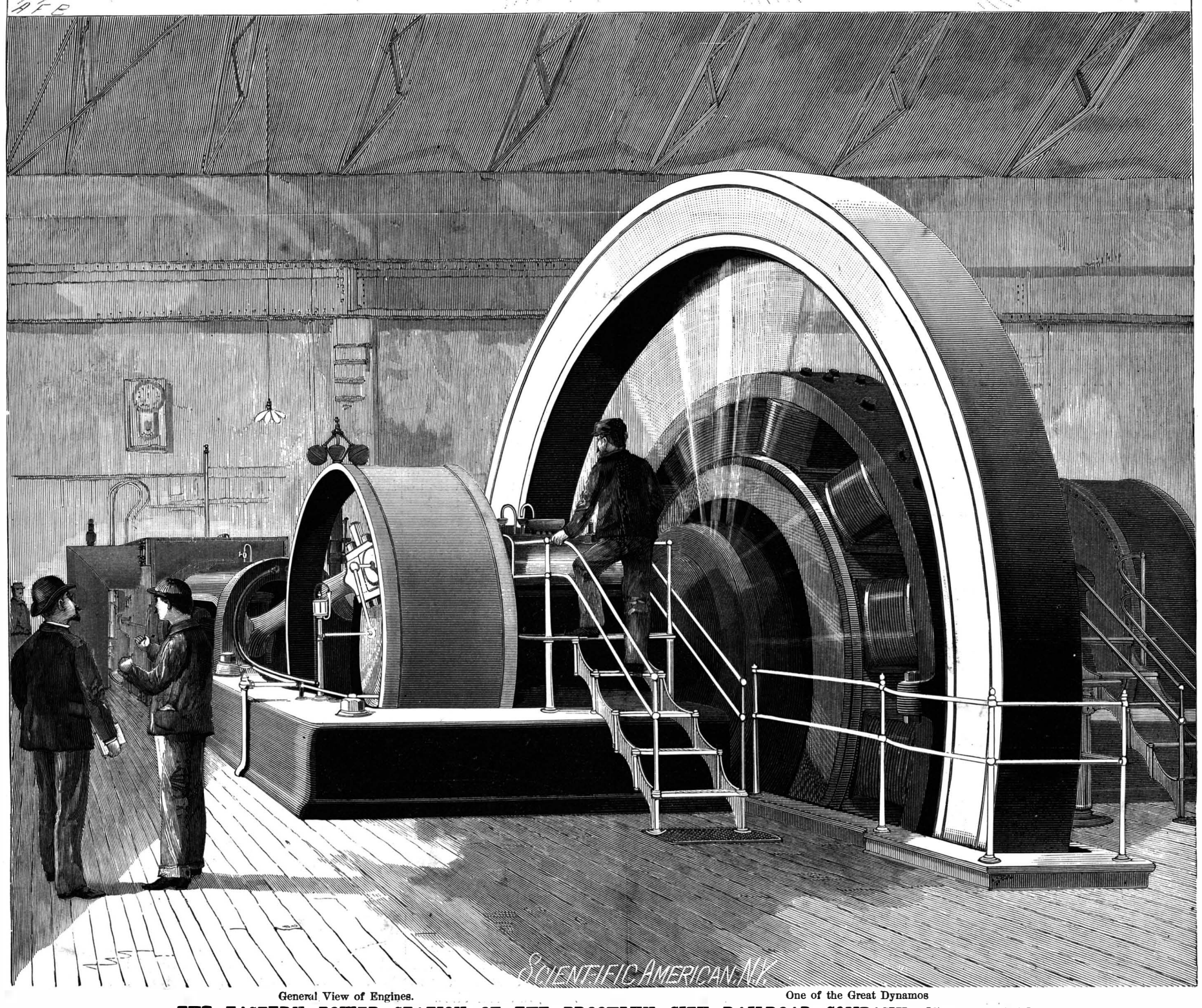


General View of Engines.



One of the Great Dynamos

**THE EASTERN POWER STATION OF THE BROOKLYN CITY RAILROAD COMPANY.**—[See page 151.]

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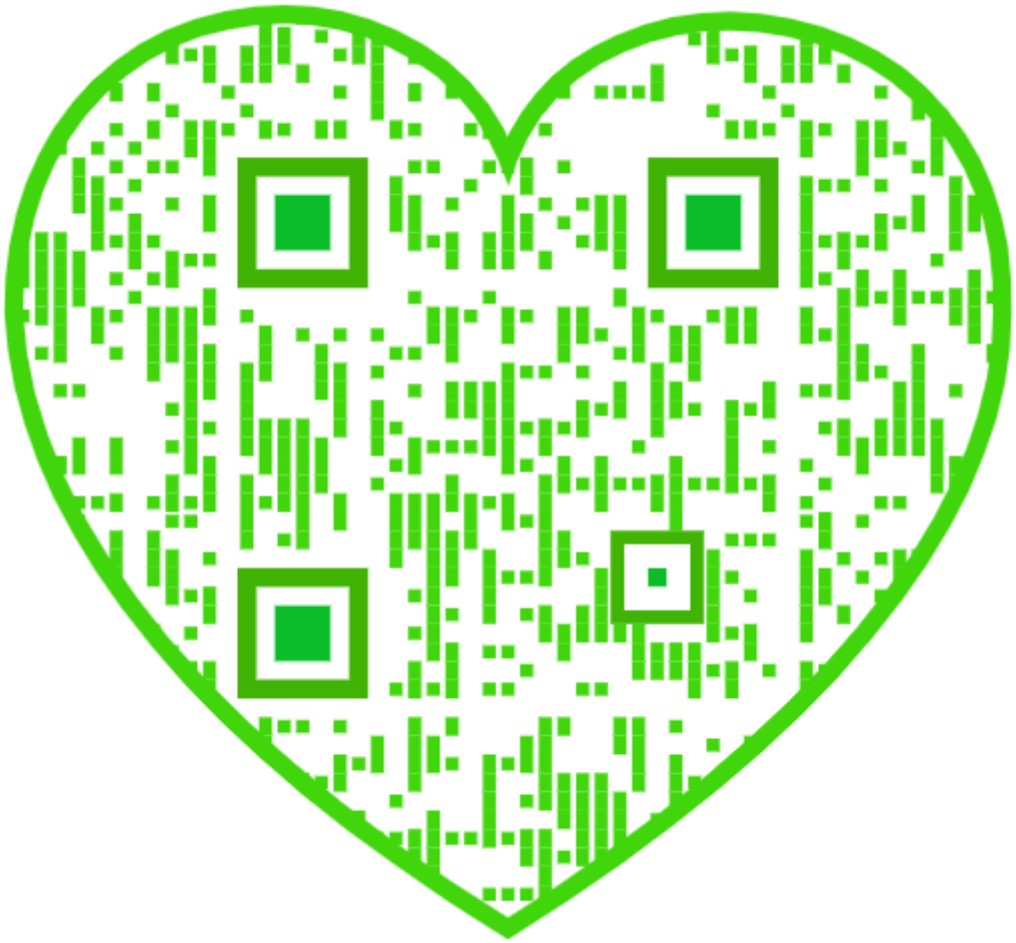

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### AMERICAN FORESTRY ASSOCIATION.

By the invitation of the citizens of Brooklyn the American Forestry Association held its meetings there at about the same time as the other scientific bodies that have been assembled. It was opened by an illustrated lecture by Mr. B. E. Fernow, chief of the Forestry Division of the Department of Agriculture. The title was attractive and suggestive: "The Battle of the Forest."

Mr. Fernow claimed that the earth is a potential forest, which if left to itself would occupy the globe. He described the development of arborescent flora through the past geologic ages. The manner was explained by which the soils were prepared by other forms of vegetation, as well as the pioneer work of certain trees, like the mangrove and bald cypress, which turn water into dry land. The first struggle is between the species themselves for light, which is only secondary to soil as an essential of tree growth. What men style "the virgin forest" is really the product of long contests that may have lasted for thousands of years.

Man's part in the battle was described by word and picture. Twelve views from the French Alps showed how, by ax and fire, over a million acres had been laid bare and eight millions ruined by the detritus thus produced. More than $40,000,000 have been spent thus far, and four times that much will be needed, to restore the damage thus heedlessly wrought. A small sum spent in protecting the community at large against individual greed would have saved the equivalent of a great revenue. Similar dangers threaten our own land. Ten per cent of the Mississippi uplands have been ruined during the last twenty-five years by the foolish removal of the forests.

The unskillful methods of the lumberman were next criticised. By culling the best species, regardless of the aftergrowth, the future value of the forest is reduced. Intelligent forestry, while using the timber crop, substitutes artificial for natural protection, thus assuring the survival of the most useful. The case of a German spruce forest was cited that contained ten times as much useful material as did the virgin forest. With this was contrasted the destruction wrought in the Adirondacks by fire, water stowage, and wrong methods of lumbering. The State should interfere; for private owners do not seem to care for the future generations. The State should own and manage its woods, and should exercise supervision over private lands to see that the whole community does not suffer from the destructive policy of greedy men. This cannot be done by such "rules of thumb" as a restriction of cutting trees of less than a given diameter, nor can the legislator tell the forest how to grow. He might as well try to legislate on the proportions of an arch. But he can encourage the skill of professionally trained foresters, instead of leaving the woodland in the hands of careless woodchoppers. The problem of saving and rightly using the forests should be treated as a business matter, to be settled intelligently, like other problems demanding wisdom, common sense, and a certain degree of business capacity.

Meetings of the Forestry Association were held for reading and discussing papers on Wednesday, August 22, in the Packer Institute, at which Hon. George W. Minier presided. Hon. J. C. Chapain, an accredited representative of the Department of Agriculture of Quebec, was introduced and spoke on the forestry of Canada. Prof. W. H. Dall read a paper on "The Forests of Alaska," dividing the Territory into three regions. The northern part is mainly composed of tundra covered with grass and moss; the middle portion is sparsely wooded with spruce, poplar, and birch; the southern part consists largely of islands with no trees except such as have been planted during the last hundred years. The heavy winds cause this prevailing treelessness, as is proved by the forest resources developed in the southeast, where the lands are protected by mountain ranges. The country south of Cook's Inlet is densely wooded with cedar, hemlock, spruce, poplar, and willow. Very little timber has yet been cut, and the forests are mainly in their natural condition.

Dr. H. C. Hovey gave an account of the vast petrified forests of Arizona, describing their origin, mode of petrifaction, and present condition. They are the remains of a forest of gigantic pines and cedars that once covered thousands of square miles. Inundated by floods of silicious waters, the woody cells were replaced by particles of silex, often stained brilliantly by ores of iron or manganese. Prostrated by earthquakes, the trunks and branches were fractured in every conceivable way, and then embedded in lava sand, some of which remains as a soft kind of sandstone, while mostly it has been removed by the elements. The visitor to this enchanted region sees a million tons of gems in sight, agates, carnelians, jaspers, onyxes, and amethysts. Many carloads of these precious stones have been removed to be polished or otherwise disposed of. The latest news is that these gems are now being pulverized, to be used for purposes similar to those now met by emery. Views were thrown on the screen and specimens, polished and in the rough, were exhibited. Microscopic slides were produced showing the cellular structure of the wood. A plea was made for the governmental protection of this wonderful region, which is now so rapidly being destroyed.

Prof. G. C. Smock read a paper on "The Forests of New Jersey." The urgent need of State regulations to promote tree culture is acknowledged by the farmers. Along the Kittatiny Mountains deforestation has progressed to an alarming extent. It manifestly affects the water supply. The commercial value of the pineries as sanitariums, like that at Lakewood, was suggested.

Mr. Verplanck Colvin, superintendent of the Adirondack Survey, read a paper giving an account of the region indicated, advocating the State Park, advising the entire non-use of the Alpine regions, on whose preservation the water supply depends, and recommending forestry experiments to restore the over-lumbered districts.

Gen. G. C. Andrews, of Minnesota, showed that forest fires cost the United States $25,000,000 annually. He cited European countries which manage to prevent such fires. We can never do so in this country until our forests are patroled and watched by men employed for that purpose. The public forests of Europe yield a steady net income of four per cent, and we might profit by borrowing some of their well-tried regulations.

As the outcome of the foregoing discussions the following resolution was unanimously adopted: That we approve of the enactment of laws, not only for the care and protection of the timber and other resources in the forest reservations, and on all public timber lands, but also for their rational use. The policy of reserving can hardly be an advantage unless followed by an intelligent administration of the reservations. This Association denies that it advocates the exclusion of large territories from actual use, and affirms that the reservations are for a rational use under proper restrictions. We therefore desire to impress on our representatives in Congress the urgency of making provisions for the better care of our public timber and other forest resources.

The Association, by invitation of the New Hampshire Forestry Commission, held a midsummer meeting after its Brooklyn session and spent several days in exploring the White Mountains. This was not merely to view the noble scenery, but also and particularly to inspect the sawmills, lumber yards, and general lumbering operations of New Hampshire. Mr. G. B. James, editor of the American Cultivator, gave an outline of his plan for preserving the woods of the mountains. The Appalachian Mountain Club also spoke of their unique work. There were other interesting lectures and addresses during the evenings of the excursion; and the result was to add greatly to the enthusiasm and interest of those who joined in the meetings.

### THE MAGNITUDE OF THE SOLAR SYSTEM.

It is the custom for the retiring president of the A. A. A. S. to give an elaborate address of considerable length, either on some topic or general interest to scientific people or on some special subject belonging to his own department of research. There are certain advantages in the latter plan; but among the objections to it may be mentioned the fact that every specialist is liable to use terms entirely familiar to himself and men of his class, but which may require some explanation for the comprehension of men in other walks of science. Possibly if Prof. William Harkness had taken the pains to explain some of the terms used in his admirable address on the Magnitude of the Solar System, it would have added to the interest taken in it by some of his hearers.

After reviewing the history of astronomy from the days of Pythagoras, Ptolemy and Aristarchus, through the era of Copernicus, Newton, Kepler and Halley, down to our own times, the speaker summed up concisely the methods and results involved in the solar parallax. First among these are the observations made of the transits of Venus, the opposition of Mars, and those of certain asteroids. Then follows the lunar parallax, as found directly and from the study of the force of gravitation at the earth's surface. The constants of precession, nutation and aberration must be obtained from observations of the stars. We must consider the parallactic inequality of the moon; the lunar inequality of the earth; the mass of the earth found from the solar parallax and also from the periodic and secular perturbations of Venus and Mars; the mass of the moon; the masses of all the planets and their satellites; the velocity of light, as obtained by experiments with toothed wheels and reflecting mirrors, together with laboratory determinations of the index of refraction of the air; the light equation obtained from the observation of Jupiter's satellites; the figure of the earth obtained from geodetic triangulations, variations in the pendulum, and the perturbations of the moon; the mean, surface and interior density of the earth.

This large group of astronomical, geodetic, geological and physical quantities must all be considered in finding the solar parallax. And it should be remarked that these are so entangled with each other that no

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one of them can be varied without affecting all the rest. It has hitherto been the custon to consider them apart; but henceforth we must determine them simultaneously.

It was to this conclusion that the speaker seemed desirous to lead his hearers through the long array of facts presented. His illustration was very felicitous. It is well known that, in geodesy, when a country is covered with a network of triangles, it is assumed that every observed angle is subject to a small correction. And as they are all entangled together in the network, they are all determined simultaneously, by an ingenious application of the method of least squares, and in such a way as to satisfy the whole of the geometric conditions. The omission of this method in any important triangulation would prove the incompetency of those having the work in charge. Like these triangles, the quantities composing the group from which the solar parallax must be determined are all subject to error, and their corrections must be so determined as to make the sum of their weighted squares a minimum, and at the same time satisfy all the equations. The main reasons why we have not availed ourselves of this method before are, first, the habit we have of overestimating our own work as compared with that of others, and secondly, our unfortunate tendency to too much specialization.

The prevailing opinion certainly is that great advances have recently been made in astronomy; and so they have in the fields of spectral analysis and in the measurements of minute quantities of radiant heat. But the solution of most astronomical problems depends on the exact measurement of angles; and in that little progress has been made. Bradley with his zenith sector, 150 years ago, and Bessel and Struve with their circles and transit instruments, 70 years ago, made observations not inferior to those of the present day. The only way in which we have improved on the telescopes made by Dolland, 130 years ago, is by increasing their aperture and relatively diminishing their focal distance. The most famous dividing engine in existance was made by Repsold 75 years ago. Only in the matter of clocks has there been any advance, and even that is not so very great. The star places of to-day are a little better than those of 75 years ago; but there is room for improvement.

Our vaunted modern instruments gave little better results for the transits of 1874 and 1882 than were had with much cruder appliances in 1761 and 1769, and whose discordance was notorious. We know that the limit of possible accuracy with any instrument is soon reached; and yet a certain fascination lures us on in our efforts to get better results. From every series of observations there always remains a residuum of error which gives us trouble.

Encke's value of the solar parallax was obtained trigonometrically, and it was never suspected till its inaccuracy was revealed by gravitational methods, which were themselves in error about one-tenth of a second, and needed to be corrected in other ways. The constant errors of any one method are accidental errors to all others, and the way to eliminate them is by combining the results from as many different methods as possible. Why ignore the work of predecessors who were quite as able as ourselves? There is no exaggeration in saying that the trustworthy observations now on record for the determination of the numerous quantities which are functions of the parallax could not be duplicated by the most industrious astronomer working continuously for 1,000 years? These observations are probably as exact as any that can ever be made unless we can invent vastly superior instruments to any yet made. To free them from constant errors we have only to form a system of simultaneous equations and deduce the most probable values by the method of least squares. With almost any possible system of weights the solar parallax will come out very nearly 8·809 seconds X 0·0057 second; whence we have for the mean distance between the earth and sun, 92,797,000 miles, with a probable error of only 59,700 miles; and for the diameter of the solar system, measured to its outermost member, the planet Neptune, 5,578,400,000 miles.

## The Antwerp Universal Exhibition.

[FROM A SPECIAL CORRESPONDENT OF THE SCIENTIFIC AMERICAN NOW AT ANTWERP.]

A correspondent of one of the Berlin daily newspapers writing from Antwerp, and comparing this Exposition with the one in Chicago, says, in substance, that the display there was the greatest and the most beautiful that mankind has ever produced, but it was too majestic to be "amusant." In this respect the Antwerp Fair is superior. This writer would probably want to have "amusant" translated amusing rather than entertaining, for he goes on to say how little faculty the Americans, especially the Chicago man, has for being amused,

This Antwerp Exhibition is certainly not majestic; it does not give one the inspiration and instruction to be gained in Chicago, neither does it give the exhaustion to mind and body, nor the despair of ever being able to see more than a small fraction of what has been brought together. This Antwerp Fair is quite within grasp, as well as amusing; it is a wonderful illustration of pluck, too! What can you call it but pluck, when a country, not as large as Massachusetts and Connecticut together, with only 5,000,000 of inhabitants, most of them poor, undertakes the very next year after the greatest exhibition ever seen to have one, and sublimely calls it a "Universal Exhibition"?

It occupies a very historic place, the site of the old south citadel, built by the Duke of Alva, and includes the adjoining part of the town, embracing within the grounds the Museum or Palais des Beaux Arts. These 100 acres lie in the southwestern part of the city, and are easy of access by omnibuses and street cars.

This is the annual week of fetes, Wednesday being Assumption day, and crowds have poured into Antwerp, so that the entrances to the Fair are dangerous places at some hours. Whether from a desire to be amused or from innate roughness, I do not pretend to say, but the crowd is a pushing, ugly one; fists and elbows are freely used. The SCIENTIFIC AMERICAN has printed a good picture of the front of the building in which the exhibits are.* It is of wood, absolutely plain, except in front. That has a good deal of ornamentation, in paint and relief, with a large dome in the center to light the rotunda. The effect of the whole is rather pleasing. Passing through this main entrance, we are at once in Belgium's own department, which occupies the largest section devoted to a single country. And a brave showing she makes, too, of her arts and industries. The pavilion directly in front of the door is in the interest of the Vielle-Montagne zinc mines, showing a wide range of uses for this metal. Within is a model of the pavilion itself, made entirely of plates of zinc; at the base are two spirited statuettes in imitation of bronze, and just as pretty, for aught that I can see, as bronze. On the sides are models of houses roofed with zinc; some of the plates are like pointed shingles, others are in corrugated strips. A model of a boat has its keel sheathed with zinc, and large sheets for that purpose lie here, along with coils of wire and cards of nails of every size. Plates for electric batteries and pails of paint show the common uses. But the application of the metal of special interest is for the prevention of the accumulation of sediment or oxidation in steam boilers. This is illustrated by a section of a boiler with what looks like a plate of zinc, measuring about 4 × 6 inches, fastened in the center. From a printed sheet on the model, I take the following: "Two years ago, one of the accidents which lead to discovery brought to light the superiority of zinc over other substances called tartriques, generally employed to prevent sedimentary deposits—the principal cause of boiler explosions. One of the machinists of the St. Laurent, a transatlantic packet, having forgotten when he left Havre an ingot of zinc of a certain weight, inside one of the boilers of the boat, was surprised when he next examined the generator not only to find no deposit adhering, but also to find no trace of the ingot he had left. This fact having been brought to the knowledge of the public by industrial papers, experiments were made in different places, and notably by the Vielle-Montagne Company, to ascertain the value of this new preventive of incrustation. These trials have given very good results."

The Vielle-Montagne has taken from one of its boilers the ingot which is exhibited. This ingot has been in the generator six months; it has lost a part of its weight and, preserving its form perfectly, has been transformed into a spongy, pulverulent mass. The phenomenon of this transformation of zinc is attributed to a thermo-electric current which is produced within the boiler. Indeed, two metals are together here, the iron and zinc, one negative, the other positive, which constitute the two poles of a pile. It is probable that the electric phenomenon preventing the formation of incrustations is analogous to that produced in the hulls of ships sheathed with zinc. It has been found by recent experiments that the proportion of zinc to use is 20 kilogrammes for 100 horse power steamers for a three months' voyage. It seems that both the German and English governments use these plates in the boilers of their ships, the consumption annually of the latter being 800,000 kilogrammes of zinc. The Vielle-Montagne Company had its first mines and factory near Liege, but within the last few years has establishments in France as well as Belgium. As a part of its exhibit it shows a model of the village near Liege, where it has an asylum for old workmen. It consists of a number of buildings, including a church, and has pretty terraced grounds about it.

Models of this kind are numerous in the exhibition, and generally give a very satisfactory idea of what they represent. For instance the porphyry quarries at Quenast, Belgium, are thus shown on a large scale; the various strata in each quarry, the tracks and trucks for moving the stone, houses of the workmen, etc. The glass manufacturers of the country have combined to make a unit of their display with very good effect. The most beautiful work has been done by the Val-St. Lambert Company; its old works, established in 1825, are at a town of that name, near Liege; of the other three factories, two are near Namur, and the fourth, started in 1882, is also not far from Liege. The annual product of these factories is valued at $1,500,000, and the workmen number 4,500. The ware is of the most exquisite quality, in form, cutting and chasing.

Beyond the glass comes a large display of porcelain made by Boch Freres, at La Louviere. There is an almost numberless variety of designs and dishes in this display; all of them are heavy and much ornamented; some bear a general resemblance to the blue Delft ware, and others much like the English Doulton. There are large plates in blue and white, with beautiful pictures in the center—far too good for anything but ornament, they are. It would be like having a fine canvas injured to have one broken. The most ambitious exhibit made by this firm is shown in a separate alcove, where upon the wall there are beautiful pictures composed of their tiles. The largest of them is a woodland scene; there are mountains in the distance, a lake in the foreground, and stags hunted by Diana, I suppose, and her maidens. It is wall decoration which would be a source of much pleasure wherever it was appropriate.

Brussels has, of course, a large showing of lace, some of it about as fine as a spider's web. It was while looking at a case of this, in which most dainty painting on white silk or satin is combined with lace to form parasols and fans, that I first noticed the word "Lotterie" attached to one piece marked $1,000, and to another marked $4,000. I have since seen objects labeled the same way all over the building, and learn that the government has authorized the sale of all these things by chances, and undertakes to see that the drawings, which take place at three different times, are conducted honestly. Gambling has been suppressed at Spa, to the honor of the country be it said, but why it is any better to conduct it officially at this exhibition, it is not easy to understand.

A Liege company makes a conspicuous display of large and high iron tubes used to conduct water and gas and has printed on the pipes the alphabetic lists of places where they have been supplied. It is interesting to know how many and distant lands look to this little one for this and other kinds of supplies.

Not only are the pipes in use in Spain, Russia, and Italy, but in the Antilles, Mexico, and the large cities of South America. Tubes for fountains are an important part of the business; a picture is shown of one, apparently of magnificent size, put up in Bucharest. It forms a broad cascade, in which there are two grottos containing figures.

As might be expected, the coal industry of Belgium makes an important exhibit. The coal is bituminous and very friable; specimens of it in large masses and small are shown by many companies, but the most interesting, because most novel, forms are what are called "briquettes," "boulets," and "ovoids." These are pulverized pressed coal, arranged in pyramids and other shapes. The "briquettes" vary in size from blocks about 6 inches square and 1½ inches thick to those as large as three common building bricks; the "boulets" and "ovoids" are in size and shape like cakes of toilet soap. A great business is now done in grinding coal and then pressing it; and apparatus used for the purpose is here. One machine consists of a large half cylinder of iron, with strong projections besetting the inside longitudinally; between these, an iron pestle, with like projections, works up and down, thus crushing the coal. A new machine made by Allard Freres, at Chatelineau, Belgium, consists of iron cylinders closely covered with pyramidal teeth about an inch high, connected with shafting so as to revolve upon each other and crush the coal. An apparatus with such cylinders does the first breaking, and one with four makes it fine enough to press. Before this is done, the pulverized coal is washed in an apparatus shown. Then the dust is put into another machine which has a hopper at the top to receive it, and falls upon a wheel covered with moulds of the size of the "boulets" and "ovoids," for both are made together, and by the revolution of other wheels upon the moulds, sufficient pressure is given to make the powder adhere. I saw no apparatus for the "briquettes." An engine of 10 horse power, I was told, is used for the washing and pressing processes. The only man who could give me any information about this pressing process said that the advantages to be derived from it are the elimination of earthy matter from the coal, the freedom from dust of the forms and their lasting longer in the fire. A very compact electric locomotive of 3 horse power, inclosed in a wooden sectional case, labeled Julien System, is used to draw the coal in a mine at Jumet. It looks to me like a vast improvement over mule power. A firm at Charleroi show an artistically arranged case of coal products which they manufacture, including lavender, rose, and yellow naphthaline in powder, and the white in flakes, balls, and other forms; they also show tar and various grades of oils.

(To be continued.)

* See SCIENTIFIC AMERICAN of June 16, 1894.

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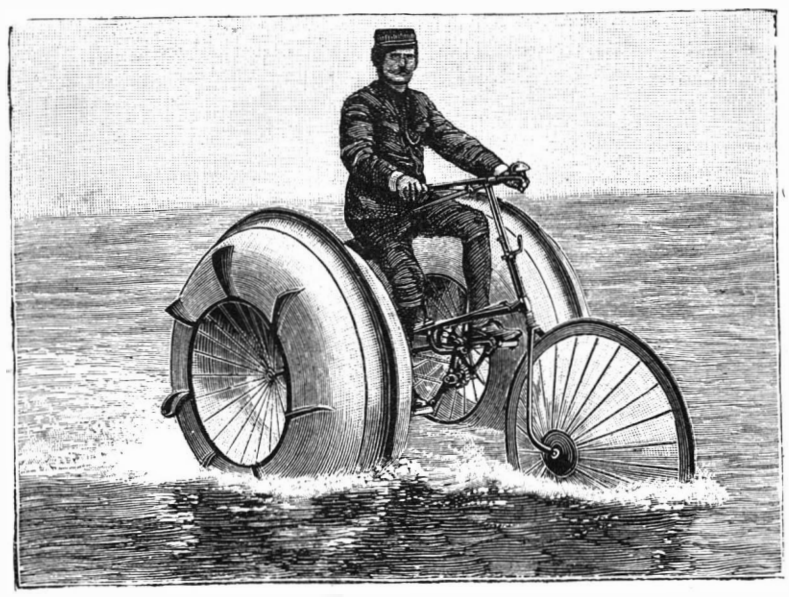
### TRIAL AT SEA OF A NAVIGATING TRICYCLE.

Mr. Pinkert is the inventor of an aquatic machine of the tricycle nature as figured below. The machine consists of three hollow wheels, air tight, with paddles fixed upon their exteriors. The wheels might be called magnified rubber tires. The wheels are worked by crank pedals after the manner of the bicycle. On this curious contrivance the inventor attempted last month to cross the English Channel, from Cape Grisnez, France, to Folkestone, England. The distance across is only about twenty-five miles; but it is difficult for navigation by small craft. A calm day was chosen, when Mr. Pinkert rolled his queer vehicle down the shore to the water's edge, and then with the assistance of a man to push he worked out through the breakers and headed for old England. It was pretty slow work, but the inventor bravely continued his exertions. After many hours of labor and when half way across the tide turned and Mr. Pinkert became satisfied he would be carried away from land; so he hailed a passing vessel and was taken on board. He will probably make further experiments.



THE PINKERT NAVIGATING TRICYCLE.

### The Manufacturing Industries of India.

In the last twenty years, the number of iron foundries and machine shops has greatly increased in India, and the country is less dependent on Europe for general ironwork; importations of wrought iron and steel are yearly increasing. The following is a list of such structures of iron and steel as are built in India: Coasting and river steamers, launches, barges, steam boilers, bridges, tanks, piers, and jetties, sluice gates, buildings, engines, steam pumps, turbines, sugar-crushing machinery, oil mills, cotton, hay, and other presses, and grinding mills. The United States consul at Bombay says that the railway companies build their own rolling stock, but they import the wheels, axles, tires, and other ironwork; rails also are imported, as are also steel sleepers, which are much in vogue in place of timber. Bolt, chain, and rivet making are not yet known as separate industries. Wire working is a steadily increasing industry, being readily taken up by the natives.

Locks, of fairly good quality, are made in Bombay and Calcutta, but none of the manufacturers appear to possess a key-cutting machine or a good set of machine tools. On account of national and religious customs, brass and copper vessels, for cooking, eating, and drinking, are to be found in every house, and the workers in these metals are more numerous than those in iron. The hollow ware is made of imported sheets hammered into shape; vessels used for cooking are tinned inside; brass hinges are made and much used on account of the destructive effects of the monsoon rains on iron hinges; the whole of the work is done by hand, without the assistance of any stamp or press. Machine tools are made, but in small quantity, most of the tools being imported. Textile machinery is entirely made in England. Agricultural implements are in small demand, on account of the poverty and ignorance of the cultivators.

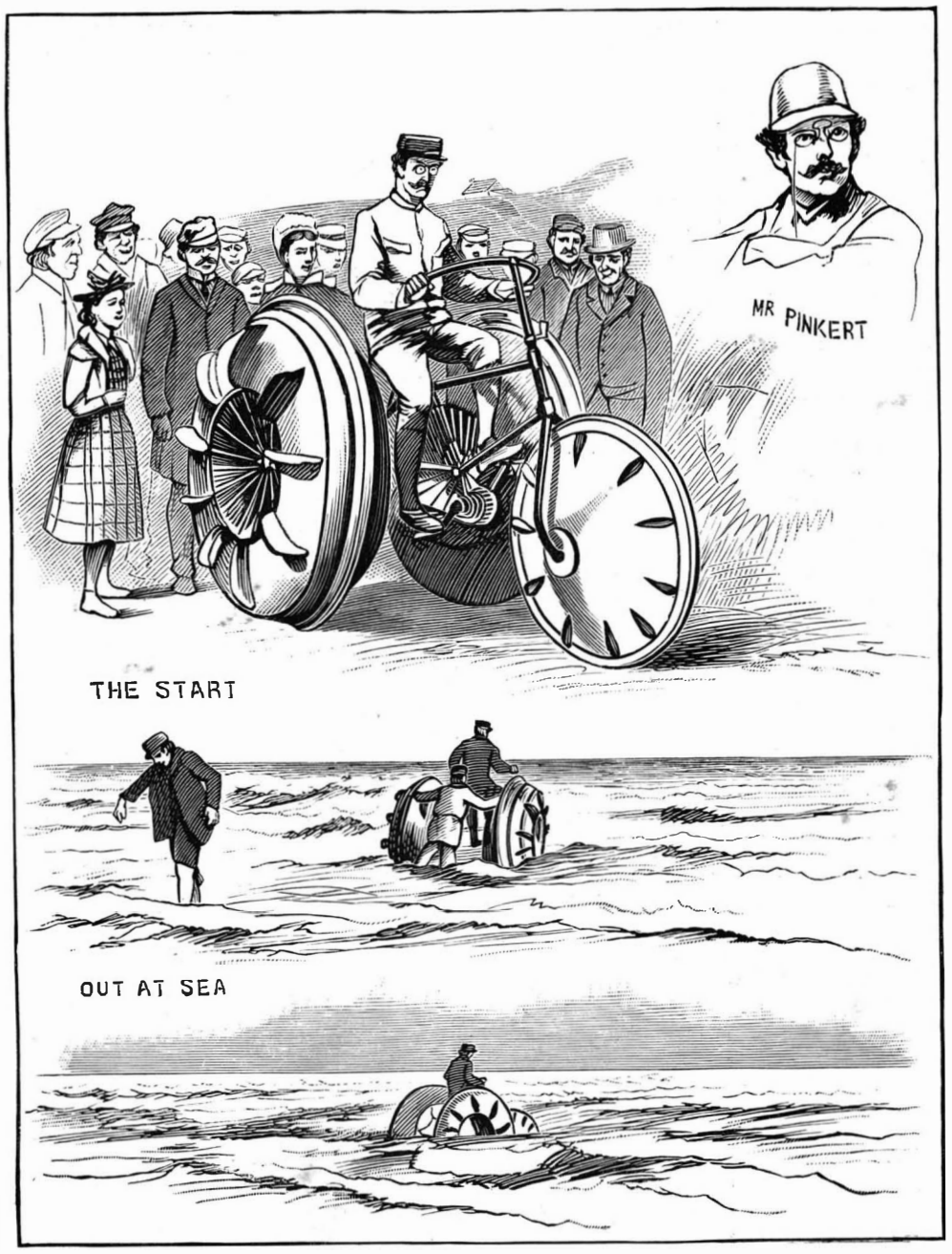
Cultivation as practiced in Egypt, the grain districts of Southern Europe, and the United States has not yet been begun in India. India possesses only one glass factory conducted on European methods, and this is in Calcutta. There are a few smaller glass factories, but when they do not use broken imported glass, they turn out goods of an inferior quality. Most of the broken glass that reaches the ports of India is sent to China, where it is worked up by the Chinese glass-wokers. Good glass-making materials are to be found in India, and a factory for the manufacture of soda water bottles alone would, according to Consul Sommer, find occupation for a large number of operatives. Window glass is now largely used throughout India, where only shutters were used before. It is obtained principally from Belgium. There are five woolen mills in India, two of which are in Bombay.

The materials made are blankets, heavy coatings, serges, and uniform cloths. Both Indian and Australian wools are used, and the future of this industry promises to be a prosperous one. There are nine paper mills in India, four of which are in Bombay. The fibrous materials used for making paper are chiefly rags and munj grass, rice straw, jute, and hemp cuttings, and old jute bags and cloth. The quality of the paper made has improved in recent years, and there is a large and increasing sale of this product. The production of paper in India has increased 118 per cent since 1885, amounting to 11,086 tons in 1891. It is expected that India will in a very few years supply its own paper, the only drawback being the cost of transportation of raw materials from great distances. There were twenty-six mills working jute and one working hemp in India at the end of the year 1891-92. The mills contain 8,695 looms and 174,156 spindles. Their nominal capital is estimated at £1,760,000. In brick and tile making there are few factories having the appliances for making bricks by machinery. The tiles most in use are of native design and manufacture.

A tube of clay is spun by hand on a very simple wheel made of wood and balanced and loaded with clay. It turns on a peg, and having been set in motion, it revolves long enough for the operation. The tube, which is tapering in form and about four feet long by four inches and a half wide, is split by a piece of string into halves, which, when dried and burned, become the country tiles of India. One layer with edges up and one layer with edges down is what is termed a single tiling. No fastenings are used, there being only one support at the eaves of the roof to prevent them from slipping off. In large towns the European pattern of tile is coming into vogue. The greatest number of European tile factories in India are in Malabar and South Canara, where water carriage along the coast affords a cheap means of transportation. The factories are closed during the rainy season.

The silk industry has not shared the prosperity of the cotton and woolen industry, for while the exports in 1869-70 amounted to 2,594,701 pounds, the exports in 1891-92 were only 1,782,438 pounds. There is a silk mill at Bombay which works only for the Burmese market; and does not venture to compete with the European and Asia Minor goods. Thana, near Bombay, used to have a thriving trade in woven figured silks, which were famous for their qualities of dye and purity, but it has now lost most of its trade, owing to European competition and a growing demand for cheap goods. There are 113 silk factories in India. The first ice factory in India was built at Agra. There have been since thirty-four factories built throughout India. There are large numbers of soda water factories; in 1891, there were 76.

Many of the smaller factories use water from stagnant wells and pools, and some filters are never cleansed, thus giving a bad taste to the soda. Many natives use the carbonic acid to make spurious champagne and other sparkling wines. Oil has been expressed for many centuries by the ghanee, a mortar having a revolving pestle driven by hand or bullock power. The residual cake contains a large quantity of oil, and is used as food for cattle. This mill is still in general use, excepting where Europeans have, a hand in the production, European machinery, of course, giving better results. Until six or seven years ago, vegetable oils were almost exclusively used for every kind of lubrication in India. At first mineral oils made a bad impression, but this was soon removed. Ghee, a clarified butter used by the natives, is adulterated with vegetable oils and animal fats.




THE PINKERT NAVIGATING TRICYCLE.

### Matter and Motion.

Apart from matter, energy has in reality no existence. We cannot conceive of motion unless something moves, of warmth unless something is heated, or of any of the various states or conditions which are indications of energy unless immediately associated with matter. Hence the co-existence of energy with matter is, to our minds, an inevitable conclusion. But now, let us inquire, can matter for an instance be considered apart from energy? Can any one imagine a body neither hot nor cold, neither in motion nor at rest, and not under the influence of some attraction, some force, or some other form of energy? No! Should such be the case for a space of time inconceivably short, that time would suffice for the rending apart of the universe. Planets would fly asunder; life would be instantly destroyed. The very ether would become, in common with all else, at once disorganized, and the universe, filled once more with impalpable world matter, would recommence, as it did millions of centuries ago, the building up of new systems, new worlds, and new men.

Energy manifests itself to us in various ways. To the physicist, light, heat, chemical action, and all other phenomena included in the category of the physical world are exhibitions of transformation of energy from one form to another. The sum total of energy in this world has never increased nor diminished. Like the matter in the universe, it is and will always be an unchangeable quantity.—Electrical Age.

THE English language contains 41 distinct sounds.

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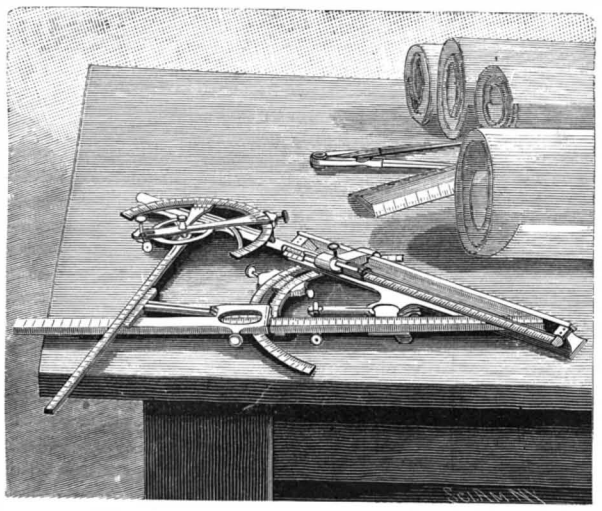
### AN IMPROVED INSTRUMENT FOR ENGINEERS, SURVEYORS, ETC.

The illustration represents an instrument of comparatively simple and durable construction, well adapted for an extended field of work. It is designed to facilitate the direct calculation of triangles without the use of plotting or other instruments, and for reading latitudes and departures for any course—down to minutes if desired—for chains, poles and links, at a single ob-

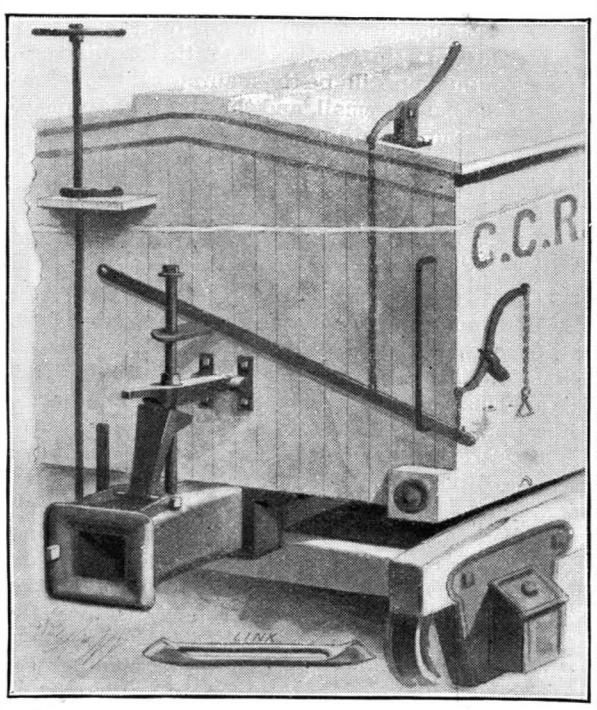


HINTON'S SURVEYOR'S INSTRUMENT.

servation. The improvement has been patented by Mr. William Hinton, of Hinton, West Va. (box 141). The base of the instrument supports a graduated distance scale on which is an adjustable slide with vernier, and on the inner edge of the base is an arm connected by a pivot with a similar arm attached to a straight meridian scale, having graduations. Graduated arcs, which may be clamped together in a sliding vernier, are pivoted to the meridian and distance scales, and on the forward end of a slide on the meridian scale is an extension on which is pivoted a T-square, with head graduated and fitted on a departure scale secured to a pivot in a bracket projecting from a slide on the distance scale. On this pivot are also two arms reading on a second protractor. The instrument is designed to be easily manipulated, and to greatly facilitate engineering and surveying work.

### AN IMPROVED CAR COUPLING.

This coupling is designed to automatically couple two meeting cars, and the uncoupling may be effected from the side or top of the car. The improvement has been patented by Messrs. James W. Tolar, of Wilksburg, and Benjamin D. Langston, of Goss, Miss. The rear end of the drawhead terminates in a downwardly inclined wall, adapted, by contact with similar inclined faces on each end of the link, to maintain the latter in horizontal position. The coupling pin is of considerable length, but has, at a proper distance from its lower end, a collar designed to rest on a collar in the top of the drawhead when the pin is lowered into coupling position. A removable head is also screwed on top of the pin. On the end wall of the car is pivoted a latch piece through which slides the upper portion of the coupling pin, and a locking dog, adapted to engage and support the latch piece, is pivoted on the




TOLAR AND LANGSTON'S CAR COUPLING

upper side of the drawhead in advance of the pin. A downwardly projecting pintle shaft passing through the dog body is pivoted at its lower terminal on a slide bolt, there being also pivoted to the pintle shaft an oppositely sliding pusher rod, pressed outward by a coiled spring. Above the latch piece the coupling pin is loosely engaged by the perforated arm of a transverse pivoted lever having movement in a guide piece, this lever being raised to lift the coupling pin, when the cars are to be uncoupled, by means of a chain connection with a tripping lever on the top of the car, or by a hand lever at the side. For automatic coupling, the link is projected horizontally from one of the drawheads, being supported at its rear end by engagement with the inclined portion at the rear of the drawhead recess, and the pin being dropped. As the link enters the approaching drawhead, on which the coupling pin is held elevated by the dog, the projecting slide bolt is pressed rearwardly, which rocks the dog and releases the pin, which drops by gravity to effect the coupling.

### The Hudson River.

The Hudson River, as we call it, along the western shore of the island of Manhattan, is now a majestic estuary rather than a river, and is deep enough for all the uses of great ships. But its present bottom is formed of the rock wreckage of an earlier day, which has largely filled up a chasm once several hundred feet deep, through which the old river ran.

So colossal was the sheet of ice which came sweeping down from the northwest over the top of the Palisades in the ice age that this ancient chasm of the Hudson River—a veritable canon once—changed its course no whit; for the direction of the grooves and scratches seen everywhere on the exposed surface of the Palisades, and pointing obliquely across the river's course, run in the same direction as do those on the rocks over which the city stands.

It not infrequently happens that steamers and ships bound for New York, when not quite certain of their whereabouts as they approach the coast, are compelled to seek what help they can by consulting the nearest land, which, under these conditions, is the sea bottom. The sea bottom along our coast has been so often and so carefully "felt" that we know a great plateau extends out beyond the coast line for some eighty or ninety miles, where it suddenly falls off into the great depths of the Atlantic. The place on which New York stands was, it is believed, once much higher than it is now, and was separated from the North Atlantic border by some eighty or ninety miles of low seacoast land, now submerged, and forming this great continental plateau. Indeed, the New Jersey and adjacent coast is still sinking at the rate of a few inches in a century.

For us to-day the Hudson River ends southward where it enters New York Harbor. But a channel, starting ten miles southeast of Sandy Hook, and in a general way continuing the line of the Hudson, runs across the submerged continental plateau, where finally, after widening and deepening to form a tremendous submarine chasm, it abruptly ends where the plateau falls off into the deep sea.

This chasm near the end of the submerged channel is, if we may believe the story of the plummet, twenty-five miles long, a mile and a quarter wide, and in places two thousand feet in vertical depth below its submerged edges, themselves far beneath the ocean's surface.

This "drowned river" is probably the old channel of what we call the Hudson River, along which a part of the melting glacier sent its flood during and at the close of the Age of Ice.

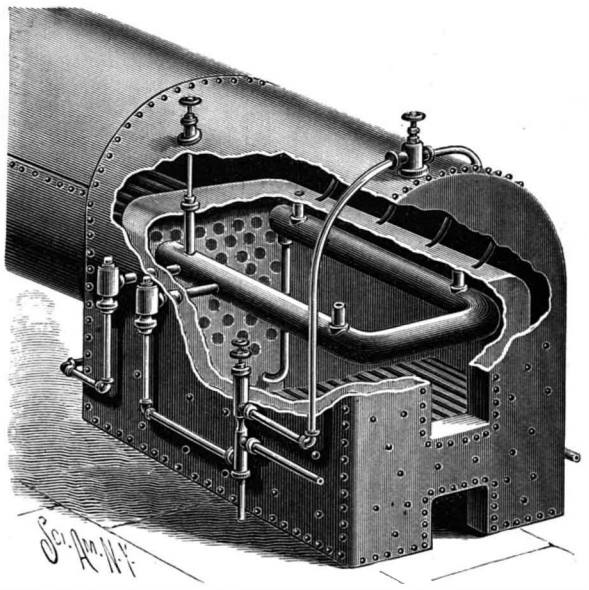
And so at last—rounded and smoothed rock surfaces, where once sharp crags towered aloft; glacial grooves and scratches on every hand; erratic bowlders, great and small, cumbering the ground; a typical rocking stone delicately poised by vanished forces long ago; a terminal moraine so great that it forms picturesque landscape features visible many miles away—these are some of the records of the great Ice Age which one may spell out in a holiday stroll about New York.—T. Mitchell Prudden, M.D., Harper's Magazine for September.

### Practical Method of Soldering Aluminum.

After numerous experiments with various suggested solders and fluxes, I am impressed that the real trouble in soldering aluminum is due to a film, probably an oxide, that quickly forms upon the surface and prevents contact and union of the metals. If this film is removed or broken up while the solder in a molten state is in contact with the aluminum, there seems to be no difficulty in obtaining perfect union. The conditions, though differing in degree, seem to be precisely the same in kind as when using the tin alloy solders upon iron; there must be presented to the solder a perfectly clean metallic surface at the moment that the molten solder is applied, in order to secure union. With iron and many other metals this may be secured by chemical means, and preserved a sufficient length of time, by means of various fluxes, to obtain the desired result. With aluminum the same procedure fails, seemingly because all the fluxes heretofore suggested fail to maintain for a sufficient length of time the indispensably clean metallic surface. I find, however, that if the aluminum is heated sufficiently to keep in a molten state the tin or tin alloy used as a solder, and then, with a suitable tool, its surface immediately under the molten solder is scraped so as to remove or break up this resisting film, union immediately takes place, without the use of any flux whatever. By this means the surface of the aluminum can be, to use a technical expression, "tinned," and the surfaces, thus prepared, readily united by soldering. I find no difficulty in thus soldering aluminum to itself or to other previously tinned metals. In the choice of alloys for solder there seems to be a wide latitude. Pure tin may be used; indeed, any alloy fusing at a less heat than aluminum, of which tin is a component, seems to give satisfactory results. Those melting at a low heat may be manipulated by the soldering iron, while the blowpipe or its equivalent is required for those fusing at a higher temperature. An alloy of tin 50, silver 25 and aluminum 25, melts at about 750°. This makes a strong solder, and promises satisfactory results.—Naaman H. Keyser, D.D.S., in the Dental Cosmos.

### AN EFFECTIVE FEED WATER HEATER.

With the improved means of boiler feeding herewith illustrated, not only will the incoming feed water be quickly and thoroughly heated, but there will be caused a rapid circulation of the water in the boiler when the feed is stopped. A patent has been granted for this improvement to Mr. William L. Harvey, of Stanberry, Mo. In the top of the fire box, suspended from the crown sheet by hollow stays, is a U-shaped tube, one end of which has a downwardly extending pipe opening into the leg of the boiler, while the other end of the tube is connected with feed water supply pipes extending to opposite sides of the boiler. These pipes are connected with injectors, each provided with a steam supply pipe leading from the top of the boiler, each injector also being connected with the source of the water supply and with an overflow pipe, either injector to be used singly or both together, as desired. On the inlet end of the U-shaped tube is a pipe extending up into the water compartment, the upper end of this pipe being normally closed by a valve, whose stem passes through the shell of the boiler and is provided with a handle. It will be seen that the water passing through the tube in the top of the fire box may become



HARVEY'S FEED WATER HEATER.

highly heated before it enters the boiler, but when the feed is stopped and the valve controlling the pipe connecting the water space of the boiler with the inlet end of the tube is opened, an active circulation will be kept up in the water in the boiler.

### A Moving Mountain.

A traveling mountain is found at the Cascades of the Columbia. It is a triple-peaked mass of dark brown basalt, 6 or 8 miles in length where it fronts the river, and rises to the height of almost 2,000 feet above the water. That it is in motion is the last thought that would be likely to suggest itself to the mind of any one passing it, yet it is a well-established fact that this entire mountain is moving slowly but steadily down to the river, as if it had a deliberate purpose some time in the future to dam the Columbia and form a great lake from the Cascades to the Dalles.

In its forward and downward movement the forest along the base of the ridge has become submerged in the river. Large tree stumps can be seen standing dead in the water on this shore. The railway engineers and brakemen find that the line of railway that skirts the foot of the mountain is being continually forced out of place. At certain points the permanent way and rails have been pushed 8 or 10 feet out of line in a few years.

Geologists attribute this strange phenomenon to the fact that the basalt, which constitutes the bulk of the mountain, rests on a substratum of conglomerate or of soft sandstone, which the deep, swift current of the mighty river is constantly wearing away, or that this softer subrock is of itself yielding at great depths to the enormous weight of the harder mineral above.—Goldthwait's Geographical Magazine.

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### Electricity on Common Roads.

The hopes cherished by some electricians as to the possibilities of electrical traction on ordinary railroads are not likely to be fulfilled by the adoption of any known system of electrical working. The most that can reasonably be claimed for existing appliances is the possibility of running a through train from point to point, but the general application of electric traction—involving the fitting up of station yards and branch lines—cannot be entertained by any sober thinking man, and even the partial application to through express passenger traffic is very improbable, for there is not much hope in any system involving a double motive power, electricity for a few special trains and steam for the remainder. There would be no money in such a double outlay.

There is, however, a field for the employment of electricity that appears to present certain possibilities of success and usefulness. We refer to its use on the common roads. Any objections that may be felt to the use of the overhead system in towns lose much of their force when country roads are considered, and there are numerous good roads in the country where, by means of the overhead system, a very considerable traffic could be conducted between towns and villages or outlying places and the nearest railway. The very onerous charges made by the railways of this country for the carriage of farm produce has had the effect of very seriously curtailing the agricultural production of the country in favor of the foreigner, whose product is almost invariably carried by our own railroads for very much less than home produce.

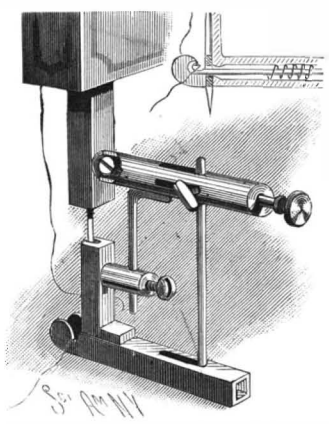
So onerous have the railway charges become—notably on the South-Eastern—that many market gardeners have, we are informed, ceased to use the line and have reverted to the roads, finding that, as compared with the railway charges, they can save both in time and money by doing so. That there must be a screw loose somewhere is evident. Horse traction has no right to be cheaper than steam traction on a railway, and, of course, would not be if the railway directors used their brains. What we should like to see tried is an overhead electrical conductor along some main road to London that is traveled by the market gardeners' vans, such, for example, as the roads from Orpington. The farmers would bring their vans to the line at the home end, and on arrival at the city boundary other horses would take off the vans to their destination, the miles between being covered by electric haulage. A suitable motor would be somewhat upon the lines of the present steam traction engine with the engine removed and an electric motor substituted. The current for such a line could very well be furnished by some existing electric light station, for the haulage is performed, we believe, in the early hours of the morning after the lights are out. The empty vehicles would be hauled back to the country as a day load, reaching home before dark, and thus being entirely a source of profit to a lighting station. Should such a scheme appear to contain the elements of success in its crude form, there is little doubt but that very shortly special motor vans would be built to replace the separate motor. A motor geared down to the axles of the van itself would involve none of the extra weight inseparable from the independent motor, while at the same time a loaded van would have ample tractive weight to draw after it other vehicles. Our English roads are so good that the traction upon them is by no means heavy, and we do not see any very inseparable difficulties in the way of realizing such an idea. Farmers must have horses, and so there would be no difficulty in bringing the loads up to the line any more than there now is in bringing loads to the railway. In many cases, too, there would be nothing to prevent a farmer having a conductor right into his farm when near the main line, and so entirely dispensing with horse traction at the home end. Obviously, the first application of the idea would be upon roads leading out of the large cities some few miles only, but the rapid extension of electric lighting to towns along the roads offers such possibilities of relays that it would frequently happen that a pole line could be carried many miles without such a gap occurring as would demand a special generating station. The outlay on such a scheme would therefore be limited to the poles and conductors, and its financial possibilities would be favorable by reason of the fact that the only power required would come in as a day load and therefore serve to reduce the cost of the electric light stations fortunate enough to be called on to supply the current. —Electrical Review, London.

### New Wood Stains.

A solution of fifty parts of commercial alizarin in one thousand parts of water, to which solution of ammonia has been added drop by drop until a perceptible ammonia odor is developed, will give to fir and oak a yellow-brown color and to maple a red-brown. If the wood is then treated with a one per cent aqueous barium chloride solution, the first named become brown and the latter a dark brown. If calcium chloride be used instead of barium chloride, the fir becomes brown, the oak red-brown and the maple a dark brown. If a two per cent aqueous solution of magnesium sulphate be used, the fir and oak become dark brown and the maple a dark violet-brown. Alum and aluminum sulphate produce on fir a high red and on oak and maple a blood red. Chrome alum colors maple and fir reddish-brown and oak Havana brown. Finally, manganese sulphate renders fir and maple a beautiful dark violet-brown and oak a dark walnut-brown. All the colors are said to be very fine.

### AN IMPROVED NEEDLE THREADER.

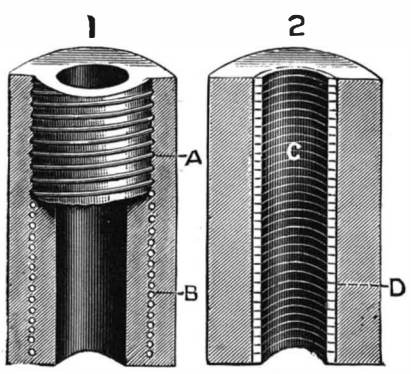
The illustration represents a device more especially adapted for threading needles of sewing machines, being easily applied to the needle bar and needle, and adjustable vertically and laterally to afford a perfect fit. It has a threading hook adapted to positively find and penetrate the needle eye and engage and automatically pull back the thread. The improvement has been patented by Mr. C. S. Goldman, Nos. 21 and 23 Center Street, New York City. Its lower portion has an upwardly extending grooved offset, adapted to receive any needle carried by the needle bar, lips notched to receive the thread extending horizontally on opposite sides to protect the threading hook, the latter having a shank sliding longitudinally in a bore which is reduced and tapered to guide the hook accurately through the needle eye. Extending up from the shank of the hook is a rod whose upper end is adjustably held by a slide block or plunger moving in a hanger tube having an open end adapted to be readily applied to a set screw on the needle bar, although the threader may be used without attaching it to the set screw. The plunger has a shank extending through the back end of the tube, terminating in a finger piece, and is normally pushed back by a spring. Extending down from the hanger tube is a rod adjustably secured by a set screw in a lug at the back of the vertical offset in which the needle is received, thus enabling the lower portion of the threader to be adjusted vertically to bring the hook opposite the needle eye. In operation the thread is laid in the notches and the operator presses on the finger piece, forcing the hook and thread through the needle, the spring carrying the hook with the thread back, so that when the threader is removed the needle is left threaded. A modification of this improvement consists in forming the shank of the hook as the spring pressed plunger, as shown in the small view, a short tube for a support only being then used as the hanger tube.



GOLDMAN'S NEEDLE THREADER.

### STRENGTHENING LEAD AND OTHER PIPES.

The illustration shows a method of making lead or other pipes to adapt them to withstand heavy pressures. The improvement has been patented by Mr. G. Wakefield Fox, of No. 104 Dickenson Road, Rusholme, Manchester, England. The invention consists in passing the molten metal through a die and around the end of a core or mandrel and simultaneously feeding a wire into the metal at the die. As shown in Fig. 1 the coil of wire, A, is completely embedded in the wall of the pipe, B indicating the cross sectional area of the pipe occupied by the wire. In Fig. 2 the coil, C, is shown embedded in the inner surface of the pipe. In each case the convolutions of the wire coil are firmly united with the metal.




FOX'S METHOD OF MAKING PIPES.

### The English Language.

The principal languages which compete with English, not considering such as Chinese and Hindostanee, are French, Spanish, Russian, and German. French is practically stationary as regards the number of its adherents; Spanish is largely spoken in South America and the southern part of North America, but it owes its prominence to the colonizing genius of its speakers; where German is introduced it rapidly gives way to the native tongue, generally English; Russian, like the German, has little influence upon the Western civilization. It is a remarkable fact that, while the English in their colonies and offshoots have absorbed millions of aliens, there is no record of any great body of English speakers having become absorbed by any other race.

In the United States there are millions of Germans and other foreigners who have become merged with the English speakers in a single generation, they losing even their family names; and the children in many cases do not understand their parents' language. In Canada, however, the French-speaking population is increasing faster than the English-speaking. This is not because the French element absorbs the English, but because it crowds it out. While the French is seldom absorbed by any other tongue, it is almost always absorbed by the English. The English has practically driven the French out of Egypt, and it is rapidly driving the Dutch out of Africa. This has been accomplished in Egypt within a dozen years. The change in Africa is being effected with even greater rapidity. As the English-speaking settlers rush into the new country, the Dutch and other languages, which are rarely to be met with, drop into the backwoods and are finally lost. Africa is witnessing a repetition of the fight of the tongues in America three centuries ago, which resulted in a victory for the English. The history of lingual development in America alone is a sufficient argument for the prediction that no languages, excepting possibly those of the Orient, will long remain formidable competitors of the English.—Troy (N. Y.) Press.

### Telegraphic Communication by Induction by Means of Coils.

In a paper recently read before the Royal Society of Edinburgh, by Mr. C. A. Stevenson, the results are detailed of some experiments with the view of establishing communication between North Unst lighthouse, situated on Muckle Flugga, and the mainland, and thence to the lighthouse station at Burrafiord, a distance of two miles. A number of experiments were made in the laboratory to discover the laws of the action of coils on each other, with a view of calculating the number of wires, the diameter of coils, the number of amperes, and the resistance of the coils that would be necessary to communicate with Muckle Flugga, and after a careful investigation, it was evident that the gap of 800 yards could, with certainty, be bridged by a current of one ampere with coils of nine turns of No. 8 iron wire in each coil, the coils being 200 yards in diameter. It was found that 100 dry cells, with 1·2 ohms resistance each and 1·4 volts, gave good results, the observations being read with great ease in the secondary by means of two telephones. The cells were reduced in number down to 15, and messages could still easily be sent, the resistance of the primary being 24 ohms and the secondary 260 ohms. The hearing distance is said by Mr. Stevenson to be proportional to the $\sqrt{}$ of the diameter of one of the coils, or directly as the diameter of the two coils, so that with any given number of amperes and number of turns to hear double the distance requires double the diameter of coils, or double the number of turns, and so on. But this is within certain limits, for when the coils are close to one another the law does not hold. With regard to the question whether or not the parallel wire system is actuated by induction or conduction, it will, Mr. Stevenson says, depend how the ends are earthed, or in short, what is the distance bridged in comparison to the breadth of base, which predominates. Where the wires are long in comparison with the distance bridged, conduction will be the main working factor, but when the base is small, and the distance bridged is large in comparison, induction will be the main factor, and the number of turns then increases the effect.

### Improvements in Mantles or Hoods for Incandescent Gas Burners.

L. K. BOHM, NEW YORK, AND T. C. CRAWFORD, NEW BRIGHTON.

The new composition material consists of about 90 per cent of magnesium oxide, about 10 per cent of silicic acid, and about 1 to 2 per cent of an alkali. The silicic acid may be partly replaced by calcium or magnesium phosphate. The most suitable alkali is potassium hydrate or carbonate. The silicic acid may be used as dry powdered $SiO_2$, but the authors get the best results by employing gelatinous silica. The gelatinous silicic acid is obtained by precipitating a solution of water glass with hydrochloric acid, filtering, and washing. One part by weight of the moist precipitate is well mixed with four parts by weight of a saturated aqueous solution of sugar, and one part of magnesium oxide, and a small quantity of alkali gradually added with constant rubbing. In this way a plastic mass is obtained which may be moulded into the form required for the mantle or hood, or spun into threads and the mantle woven. The hoods are then burned in a baking oven. In this way a mantle or hood is produced such that, while consisting mainly of free magnesium oxide, it is an efficient glow body, contains a skeleton of a double potassium and magnesium silicate giving great stability and hardness.

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### THE EASTERN POWER STATION OF THE BROOKLYN CITY RAILROAD COMPANY.

The eastern power station of the Brooklyn City Railroad Company may be taken as an example of as close an approach to the perfect type of an electric generating plant as has yet been produced. In its intricate connection of parts it is most ingeniously arranged, and every appliance used with it embodies the most recent improvements. It supplies electric power for many miles of trolley road in the city of Brooklyn. Like all modern electric generating stations, it has a steam plant of the most perfect description for keeping an exact watch of the results obtained in the development of mechanical energy. The conversion of mechanical into electrical energy is effected by dynamos, which, with the comparatively simple switches and safety cut-outs required, constitute the electrical parts of the installation. The works are situated on the corner of Kent and Division Avenues, Brooklyn, E. D., on the banks of the East River. In the cuts we illustrate the dynamos and engines, which portions of the plant are accordingly to be described first. The complete station calls for six engines and dynamos; at present four of each are in place. Each engine is of the cross compound type, the high and low pressure cylinders being respectively 32 and 62 inches diameter, with 5 feet stroke. They run at a speed of 75 revolutions per minute. The flywheels, which are put together in sections, weigh 70 tons each, and each engine shaft, which extends from engine to engine and carries also the dynamo armature, weighs 56 tons. The journal portion of the shaft alone is 4 feet long and 2 feet in diameter. The normal horse power of an engine is 2,500. The steam connections of the different engines are so arranged that they can be run in any desired way; a single cylinder of either the high or low pressure size may be operated alone, either with or without condensing; or, as in the usual course of things, both cylinders may be worked in succession on the compound basis. Two governors are mounted on each engine; the low pressure governor regulates the speed; the high pressure governor is a safety device and has no effect upon the engine until a certain speed, set as a safe one, is exceeded, when it operates a throttle valve and cuts off the supply of steam, bringing the engine to a dead stop.

The engines are supplied with oil through pipes by the Anderson automatic lubricating system. Under a 15 pound head, oil passes through pipes to all the journals of the engine, and in addition a supplementary set of pipes is employed to feed water to the different parts, if such should be required as an adjunct to lubricating or to cooling the parts. The oil and water before use are carefully purified.

Each shaft is provided with wedges operated by screws accessible when the engine is running. By these the shaft can be shifted vertically or horizontally, so as to keep the armature perfectly centered in the field. The dynamos, each of 1,500 kilowatts capacity and 500 volts potential, are of the well known multipolar type of the General Electric Company. Each dynamo has twelve pole pieces, and the current is taken from the armature by twelve carbon brushes. As at present organized, the maximum current given by the station is 5,600 amperes, the station having a capacity of 800 cars. While we only illustrate the engines and dynamos of this station, the steam generating plant is itself an object of great interest, with its many connections. Twenty-four Babcock & Wilcox tubular boilers, distributed over two floors, are used. Eventually, thirty-six—eighteen on each floor—will be introduced. These boilers are fitted for natural or artificial draught. The natural draught is maintained by a brick chimney 296 feet high, with a 17 foot shaft. Two 12 foot Sturtevant blowers are connected to a great nozzle in the base of the chimney, by which induced draught may be supplied. The steam is delivered to the engine by a 20 inch steel, flange-jointed main. Wheeler's surface condensers are supplied for the engines. The feed water pipes, whose main line is 8 inches in diameter, are all of cast brass or of high grade mandrel-drawn brass pipe. Worthington pumps are used for the water supply. Green fuel economizers utilize the waste heat from the products of combustion for heating the feed water. A system of thermometers and pyrometers is connected with the draught flues and chimney, so that an accurate watch can be kept upon the operation of the economizers, so as to get the maximum economy from them without interfering with the draught. A roof coal pocket of 6,000 tons capacity contains the coal. This coal is distributed to the boilers by weighing tubes supplied by the Howe Scale Company.

### The Scuppernong.

A correspondent of the Country Gentleman speaks of a Scuppernong grape vine from which forty bushels of grapes have been sold for two successive years, and it is probable that it will produce fifty bushels this year. The vine is trained over an arbor some 25 feet long by 18 feet wide, and is a foot in diameter at the ground. This is not at all an uncommon size, and a vine might easily cover an area of 2,000 square feet. The Scuppernong will not thrive north of 37° of latitude, but it is well known as thick-skinned grape which keeps well and can be shipped long distances. It has a peculiar flavor, which is not diagreeable to many people, and it makes an acceptable wine. It reaches its best development in southeastern Virginia and northeastern Carolina, where it runs wild and often climbs 40 feet or more into tree tops. If allowed to grow with no pruning or care, except a trellis or something to run upon, it will usually give fair crops.

### The Sun and its Flames.

The present state of the science of the sun, upon whose rays our whole life is dependent, is summed up by Mr. Camille Flammarion in the last number of Astronomie. The sun, as we know, is just at present occupying the entire attention of astronomers. Its spots, which are becoming more and more manifest, demonstrate that it is passing through a phase of extraordinary activity. These spots are so large that several of them exceed the diameter of the earth by at least six times. The luminous surface of the sun is at the same time shining like a true ocean of fire and projecting above it brilliant eruptions and fantastic flames that are from three hundred thousand to three hundred and fifty thousand miles in height. Something, then, is taking place in the sun; and, as distant as we are from the king of the stars (94,000,000 miles), our poor little globe feels the effect of the revolutions that are being effected so far from her. As a proof of this, it is only necessary to observe the curious magnetic disturbances that act upon the magnetized needle. Let us endeavor, then, to set forth the mysteries whose theater is the sun. Let us give a few ideas as to the size of this orb, and state in the first place that it weighs 324,000 times more than our globe, and that an express train, running at the speed of about 3,000 feet a minute, and at a constant speed without interruptions, would take 149,000,000 minutes, or 283 years, to reach us, and that, notwithstanding such remoteness, the solar energy is so prodigious that the heat received by the earth suffices to keep up here all the phenomena of vegetable, animal, and human life; for everything that moves, everything that lives around us, comes from the sun. Wood, coal, gas and electricity —all are stored up sun.

Mr. Flammarion recalls the curious calculation according to which the calorific power of the sun is so enormous that it would cause to boil ten trillion cubic miles of water at the temperature of ice! Finally, if the sun should come to the distance of the moon from us, the entire earth would melt like a ball of wax.

Let us add that the attraction between the sun and the earth is almost instantaneous, and we shall see that we are the true children of the sun, and that we are dependent upon and live only through it.

What is this solar surface that puzzles us so much? When we study it by the telescope, or by means of photographs, we see that the solar surface is not smooth, level, and homogeneous, but granulated—covered with grains and strewed here and there with spots of varied dimensions. This solar surface is not solid, nor liquid, nor gaseous. It is, upon the whole, but a stratum of luminous dust that floats upon an ocean of very dense gas having nearly the density of water. The spots are apertures formed in this solar surface. When we observe them they seem to be black, but this is merely an illusion caused by contrast. In reality, these nuclei are 2,000 times more luminous than the full moon. Above the solar surface there extends all around the globe a stratum of burning gas of about 9,000 miles in thickness, which is called the chromosphere and in which hydrogen prevails. This stratum is rose-colored and entirely transparent. It is from thence that proceed those flames of from 300,000 to 350,000 miles in height, and likewise rose-colored—those gigantic perturbations that have their rebound upon the earth and that so greatly perplex astronomers. It is to this that are at present directed the scientific observations which the illustrious author sums up thus:

"At the Observatory of Paris Mr. Deslandres has succeeded for some time in photographing invisible flames upon the very surface of the solar disk. A most ingenious photographic process, founded upon the spectroscopic aspect of the lines of the spectrum of calcium (one of the metals that exist in the solar atmosphere), reveals the incandescent masses of the chromosphere and of the protuberances. These images of the vapors of calcium, these facular flames, are not the faculæ or white spots that are perceived distributed here and there over the surface of the radiant star; they resemble them, but do not coincide with them. They are formed by the most intense parts of the chromosphere and protuberances. This new apparatus, the spectrograph, does not give a photograph of the faculæ of the photosphere, but an exact image of the chromosphere such as it would be seen were the photosphere removed. It is the first time that these flames have been photographed, not around the disk, as at the time of eclipses, but in front of the solar disk itself.

"It is quite curious, but not a rare thing in the history of the sciences, that precisely at the time that such studies are being made in France by our learned colleague, Mr. Deslandres, they are being pursued in America by Mr. Hale, dirctor of the Kenwood Observatory at Chicago.

"So the flames of the sun, sung upon all lyres, are no longer a metaphor; the star of day bristles with them. Their number and size vary like the spots themselves. A maximum of activity manifested itself in 1871; again in 1883, but less strongly; and now, for six months past, the star has been in a state of excitation that much surpasses the last. Such fluctuation is of about eleven years; we do not as yet know the cause of it.

"But the most curious point, perhaps, is that these manifestations of solar activity have their echo, their repercussion, upon our planet in the variations of the magnetic needle. The more movements there are upon the sun, the more this needle is agitated here, at 94,000,000 miles distance! Sometimes, even, the agitation is so violent that the compass is entirely disoriented, that an immense magnetic disturbance exhibits itself over the entire globe, that telegraphic communications are interrupted, and that telephones refuse to operate. This is especially what happened on the 25th of February last. And then one speaks to us of a void between the stars! No, space is not void; it is, on the contrary, a bond of communication between the worlds. The fearful solar tempests, in comparison with which our most violent storms, our thunder, our volcanoes, and our earthquakes, are but as the smiles of an infant in the cradle, make themselves felt here, and, unquestionably, upon our neighboring worlds, Mars and Venus, at the same time. We might say that we have here already something like an electric, telephotic communication. Who knows whether some day, soon perhaps, an Edison will not find a means of hearing these voices of the sun and of receiving the perturbations of Mars and Venus, and of seeing them, perhaps, if they manifest themselves as they do here by auroræ boreales. We are at this very moment at the maximum of auroræ, and more than ten have already been observed since the beginning of the year. I may add also that, according to my personal observations, which doubtless may be confirmed by others, the zodiacal light, which is remarkably intense this year, offered an analogous maximum in 1871."

Notions as to the solar spots, of which it is so much a question in contemporary astronomical science, are of very ancient date. Ovid and Virgil speak of the spots, and Chinese astronomers observed them from the year 301 to the year 1205 of our era.

In the middle ages people did not wish to admit their existence, as it was opposed to the science of Aristotle.

On this subject Mr. Flammarion cites a very instructive anecdote. Father Scheiner, a Jesuit of Ingolstadt, observed them scientifically for the first time in 1611, and referred them to the provincial father of his order. The latter, a pronounced peripatetic, astounded at such a discovery, answered that it was certainly imaginary; but that, in order to be agreeable to the observer, he would verify the accuracy of it. The next day, Father Scheiner came to ask a definitive solution, and the provincial father answered him:

"I have reread Aristotle all through, and I can assure you, my son, that there are no spots upon the sun. They are in your eyes or in the glasses of your spectacles."

No matter. Notwithstanding Aristotle, the solar spots have made their way. Not only does science now admit their existence, but is still striving to rob them of their secrets.—La Revue des Revues.

### Report of the Commissioner of Patents.

The customary annual report to the Secretary of the Interior, for the fiscal year ending June 30, 1894, by Mr. John S. Seymour, Commissioner, has just been published in the Official Gazette, from which it appears there were received in the fiscal year ending June 30, 1894, 35,952 applications for patents; 1,050 applications for designs; 108 applications for reissues; 2.193 caveats; 1,720 applications for trade marks; and 368 applications for labels. There were 22,546 patents granted, including reissues and designs; 1,656 trade marks registered; and 2 prints registered. The number of patents which expired was 13,167. The number of allowed applications which were by operation of law forfeited for non-payment of the final fees was 4,566. The total expenditures were $1,053,962.38; the receipts over expenditures were $129,560.80; and the total receipts over expenditures to the credit of the Patent Office in the Treasury of the United States amounts to $4,409,366.74.

During the past year there has been a notable falling off in the applications for patents, designs, etc. For the year ending June 30, 1894, the number was 39.206, against 43,589 for the previous year, and more than the last mentioned number for each of the three prior years. The cost of publishing the Official Gazette was $113,642, of which 7,000 copies were issued weekly, the cost of each copy being a little over $16 per year, while the subscription price is only $5 a year. The paid circulation is small. A large number are given away.

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### The Chinese Foot Binding Practice.

According to Dr. Haslep (China Med. Missionary Journ., June, 1893) the ordinary method of binding the feet is as follows:

While the great toe is left straight, the other toes are folded on the plantar surface of the foot, often until the tips of the toes are on a line with the edge of the inner side of the foot, and then the foot is bound "snugly." Gradually the bandage is made tighter and tighter. When the metatarsal bones begin to curve, making the characteristic lump on the dorsum of the foot, the bandages are tightened more rapidly than before. If swelling takes place above the ankle, the foot is bandaged more tightly. If ulceration occurs, the foot is bandaged still more tightly. Swelling is not a desirable complication. Ulceration is greeted with joy, for it is usually a sign that the foot is yielding gracefully to the inevitable. "Lan siau kiah" (ulcer, small foot) is a common saying. To make the smallest foot with the minimum of suffering and produce no untoward results is the desideratum; this process should take about ten years. Patience will then show her perfect work; that which foreigners call a deformity and restricted locomotion are necessary sequelæ, not untoward results. They begin to bandage the feet of a child when she is between three and four years of age. Generally the services of a professional bandager are obtained. This woman carries with her a stock of small wooden shoes of various sizes. These are the patterns. Her patrons choose the size desired. A contract is then made to have the foot of this size in a certain length of time—three years or more or less as the case may be. The professional bandagers, for the most part, fulfill their contracts with superb indifference to the children's sufferings, and sometimes with such results as the death of the child, gangrene of the feet, necrosis of bones, etc.

### Salophen as an Anti-rheumatic.

According to the observations of Drs. B. Ciullini and A. Viti, at Siena, salophen is an excellent remedial agent, both in acute and chronic rheumatism, its advantages over salol and salicylate of soda being that it is tasteless, not hygroscopic, and devoid of unfavorable after-effects.

Its chief indication is in the initial stages of acute arthritic and in mild or subacute cases. In obstinate or chronic cases it is advisable to follow its administration with that of iodide of potassium. The antipyretic action of salophen is not marked. In the intestinal canal it acts as an antifermentative, and it destroys the reaction of indican in the urine. Doses as high as 5·0 to 6·0 gm. pro die continued for several days are not attended with disturbances of any kind.—Terapia Clinica, April 4, 1894.

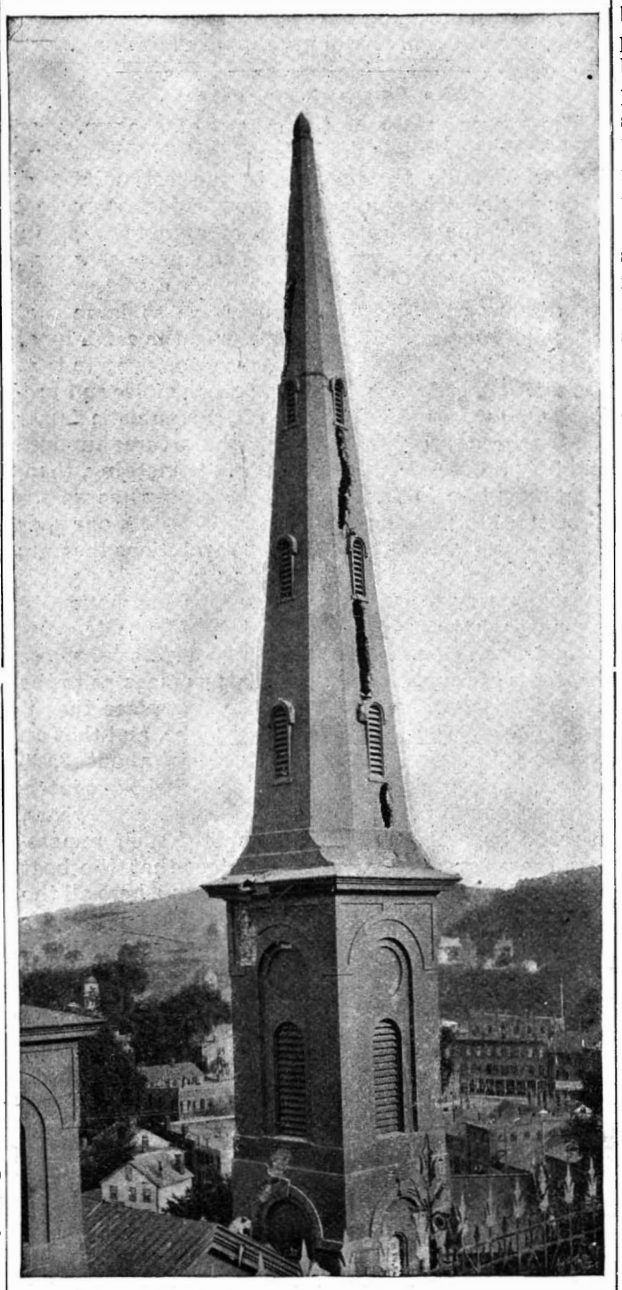
### A TREE SHATTERED BY LIGHTNING.

We are indebted to Mr. Frank Woodmancy, of Sidney, O., for the accompanying photograph of a tree which was struck by lightning on the farm of Norman Key, four miles east of Sidney, Ohio, on the morning of March 15, 1894. The tree stood in an open field and was of the species known as burr oak. The tree was tall and healthy, and the trunk measured over two and one-half feet in diameter. Slivers of the tree were scattered over the field, some being thrown more than 60 rods away.

In such cases it is supposed the lightning converts the sap of the tree into steam with such tremendous energy as to cause the wood to explode in all directions. The process of the late A. S. Lyman, patented in 1858, for preparing wood for paper pulp, was based on the same principle. Lyman provided what he termed a steam gun, which consisted of a long steam boiler wherein blocks of wood were boiled under a very high pressure, and at the proper stage in the operation one end of the boiler was suddenly opened, when the contents shot out, and with a report like a cannon the fibers of the wood exploded, converting the wood into fine shreds.

### CHURCH SPIRE, NORWICH, CONN., STRUCK BY LIGHTNING.

We are indebted to Mr. F. J. Moulton, of Norwich, Conn., for a photograph showing the damage done to the spire of the Broadway Church, in that city, by lightning on the 29th of July last. We give an engraving herewith. The spire is of brick, 198 feet high,



CHURCH SPIRE, NORWICH, CONN., STRUCK BY LIGHTNING.

with a cap of brownstone. The spire was not protected by lightning rod. The stroke took place during a terrific thunder storm about 1.30 P. M. Spectators say it was a fire ball that fell upon the spire, which then exploded, blowing out the brick walls in several places and leaving rents, some of which were fifty feet in length. The debris, in the shape of bricks and mortar, was hurled in all directions to considerable distances.

The simple expedient of a lightning rod, well grounded, would, doubtless, have saved this building from injury.

### Printing Out Papers.

Within the past four years considerable progress has been made in the production of ready printing out papers, which are distinguished from those required to be freshly sensitized and printed from the day they are prepared in the fact that, when once made, the ready sensitized will keep intact for several months, and may be used at any time and in any climate. Since the manufacture of gelatino-bromide paper began, about thirteen years ago, improved methods have been invented for coating paper with collodio chloride emulsions, until now a high degree of perfection has been reached. Instead of collodion as a medium, gelatine emulsions are used as a vehicle to hold the chloride of silver salts. Each has some faults or difficulties. A medium between them has recently been perfected in paper called the Nepera, which we have tried with considerable success. It possesses a particularly tough film, which is insoluble in warm water, and can be turned or bent upon itself without the least injury. It is also very easy to work and prints rapidly. No extra care is required in the toning or fixing operations. It is well adapted for use in warm climates, because of the toughness of the film.

The prints should be printed quite a little darker than it is desired to have them. They are first put in water, which is changed two or three times until the milkiness disappears. At this stage they are a light red color and are immersed in the toning bath made as follows:

| | | |
|---|---|---|
| Water | 30 | ounces. |
| Acetate of soda | 60 to 90 | grains. |
| Borax | 25 to 30 | " |
| Gold solution (15 grains of chloride of gold dissolved in 15 ounces water rendered alkaline with bicarbonate of soda) | 1 to 2½ | ounces. |

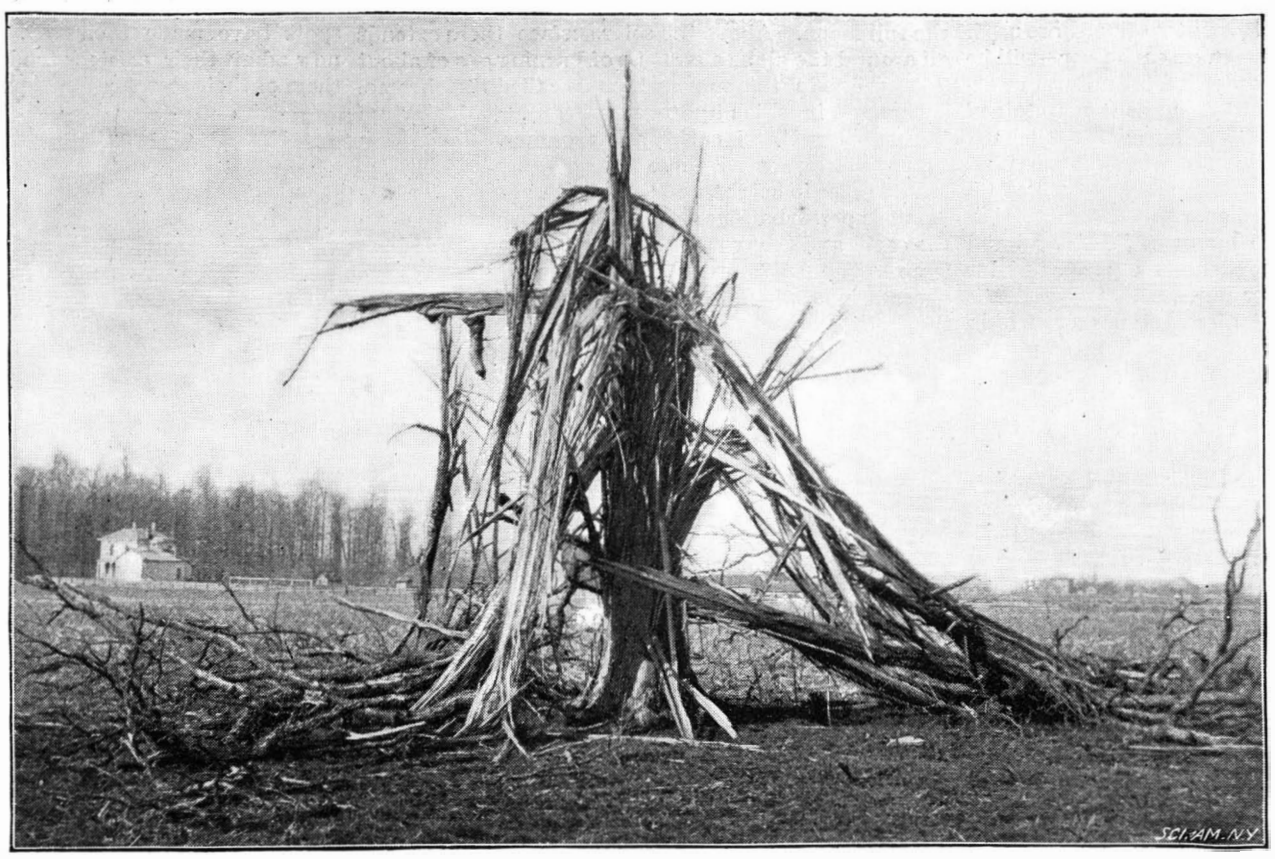
The toning takes from five to eight minutes. It is essential that the bath be alkaline, and it should be tested with blue litmus paper, which should not turn red when dipped in the solution.

From the toning bath the prints are transferred to an acetic acid acidulated bath for a minute or two. Just enough acid is added to the water to produce a slight acid taste.

After the acid bath (which checks toning action and clears the whites) the prints are put into an alkaline hyposulphite of soda fixing bath for ten minutes. The bath is made up of 1 ounce of hyposulphite dissolved in 16 to 18 ounces of water, or to about 12° or 16° hydrometer test. Then the prints are washed for an hour in changing water, and when dried are ready to be mounted.

In all these operations there is no tendency of the paper to curl up—a great convenience where large numbers of prints are handled. It can be squeegeed while wet on a ferrotype plate, which gives it a high polish, or it may be burnished, the same as a silver albumen print. The Nepera Chemial Company also make a new bromide paper, called platinoid, from the fact that when printed, developed, and fixed, it has a color very similar to the popular platinum print.

Machines are perfected for printing rapidly on this paper by means of electric light. An establishment in this city is able to make on a continuous large roll several thousand exposures in an hour. The paper, still in ribbon form, is then automatically passed through a developer and fixing bath, and at last dried, the pictures being afterward cut out. Duplicate photographic prints are thus made very uniformly.




A TREE AT SIDNEY, OHIO, SHATTERED BY LIGHTNING

A GREAT deal of trouble is expended in educating the showy, high stepping horse. He is trained to step high and act showily by being driven along a path whereon rails are set crosswise; he steps high to avoid stumbling, and in time always steps high.

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### BROADWAY DURING A FIRE.

The exigencies and necessities of the crowded life in cities are every day becoming more developed. Special conditions are established under the influence of growth and development, and these have to be met in their turn by new appliances and arrangements. The illustration we present with this article, giving a scene on Broadway during a fire, is one of special interest and exemplifies what we have said above. The shape of Manhattan Island, on which the original city of New York was built, is such that the principal travel is in a general sense north and south, and Broadway monopolizes a greater part of such travel than that which goes over any of the other up and down streets. After much opposition a horse railroad was put in operation over this street, and then, with a further surrender of vested rights on the part of the public, a cable road replaced the horse cars, and the traffic was greatly facilitated.

Our illustration shows a portion of Broadway near the offices of the SCIENTIFIC AMERICAN. It is a reproduction of a photograph taken during a fire, and gives an admirable idea of the great thoroughfare when to a portion of its natural business is superadded the excitement of a fire. Of course the through traffic is to a great extent interrupted, the streets on either side being taken during the time of the fire by trucks and carriages. In the foreground a steam fire engine holds a conspicuous position and the delivery hose therefrom is seen leading across the street over the tops of vehicles and cable cars. It is here that one of the recent advances in city life appears. The Metropolitan Traction Company, who own and operate the cable road, maintain two patrol wagons, whose duty it is to respond to calls sent in by the company's inspectors, who constantly travel up and down the line. One of the calls is for fire service. For use at fires the patrol wagon carries eight pairs of shear legs, 20 feet high, and uses them as shown for raising the fire hose above the tops of the cable cars, thus leaving the track clear for them to go on their regular route. Devices of this sort for street cars have already occupied the thoughts of inventors, and little bridges to enable the cars to pass over the hose have been suggested. But for cable cars such bridges are inapplicable, as the grips would interfere with the hose. Hence the system shown has been adopted with much satisfaction to the public as well as to the car company. In our issue of June 23, 1894, we give a fuller account of the operations of the patrol wagon, of whose work the present cut shows only a single phase.

One of the most striking features of the cartraffic on Broadway is the number of cars engaged therein. On the least interruption a long row of cars rapidly accumulates. In the cut is seen a quantity of cars thus brought together in spite of the facility given for their progress by the raising of the hose.

BROADWAY DURING A FIRE.

### Gold in Nevada.

In many places on the Pacific coast, says Dan De Quille, a great fuss is made about gold quartz that yields from $5 to $10 a ton. Here but little is thought of such prospects. In regard to some of the gold belts of Nevada, I find the following notices in the local papers for the past three days:

Three and a half tons of ore from the Palmico mine, Hawthorne, yielded $4,050 in gold.

A lot of fifteen tons of ore from the Irish Boy mine, Kennedy district, sent to Selby's smelting works, San Francisco, for reduction, paid $512 a ton. The vein is from two to four feet wide.

A ledge, just found, a mile and a half from Unionville, Humboldt County, assays from $140 to $1,800 a ton in gold. The vein is two feet wide.

In Lincoln County, Scott Allen accidentally found a vein of iron-stained quartz. He did not think much of his find, but an assay showed that the material contained over $3,000 a ton in gold. This find was made in a section of country some distance south of where Captain De Lamar is operating.

These paragraphs are in regard to only a few districts or sections of the many gold belts. In the Kennedy district—first discovered in July, 1891—are the Cricket, Imperial and many other mines as rich as the ones mentioned above. Indeed, it is a region full of rich veins of gold-bearing quartz, and finds are still being made almost every week. No place in Nevada is more worthy of the attention of the capitalist or prospector.

A railroad down through Nevada, one that would connect Salt Lake City with Los Angeles, would open many good gold camps. The whole route would be through a region full of mines of the precious metals. Down toward Death valley lies Montgomery district, a good gold camp, but one that is almost out of the world as regards transportation.

Also down near Death valley, in Tule canyon, some rich gold mines should be opened. On this canyon rich dry diggings were discovered some fifteen years ago. In 1880 a few men were at work there. They had no machines for dry washing, and did not even winnow the dirt by tossing it up in the wind, Mexican fashion. They simply dug over the ground with picks, collecting such pieces of gold as they happened to see. In this way they made good wages in ground from two to four feet deep. Working in this rude way they found one nugget that weighed five pounds, and very many worth from $5 to $75. Pieces of gold worth about fifty cents were about the smallest saved working in this way, "by eye." With water or even dry washing machines, such ground should have paid immensely. As all the placers in the Great Basin region are of local origin, Tule canyon must cut one or more large and rich veins of gold-bearing quartz. At present we hear but little about these diggings, though there is always more or less gold coming from them, which is said to be ground out in arrastras by some of the ranchers living in the vicinity.

In the early days an impression prevailed among our miners and prospectors—mostly from California—that the gold veins on this side of the mountains would not prove permanent. They said it was merely a surface production and would not hold out in depth. This soon came to be accepted as an established fact; therefore little attention was given to veins that were purely gold-bearing by those who went forth on prospecting raids. Now the truth is that our gold mines are the most permanent in the country. The first gold mines opened and worked were in Devil's Gate district, at Silver City. These have been worked right along unceasingly for over thirty years, and to-day are paying their owners as well as at first. Wherever paying gold mines have been found in Nevada they are still paying, as in the beginning, and this is more than can be said of many of the silver mines.

MRS. ERNEST HART, who recently made a trip around the world, appears to come to the conclusion that meat eating is bad for the temper. She says that in no country is home rendered so unhappy and life made so miserable by the ill-temper of those who are obliged to live together as in England. If we compare domestic life and manners in England with those of other countries where meat does not form such an integral article of diet, a notable improvement will be remarked. In less meat-eating France, urbanity is the rule of the home; in fish and rice eating Japan, harsh words are unknown.

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### Use of Peat Fuel in Germany.

The United States consul at Bamberg says, in his last report, that the numerous inquiries that have been addressed to him on the subject of cheap fuel have caused him to give careful attention to the process by which many parts of the German empire secure their supplies of that comparatively inexpensive, but yet satisfactory, fuel—peat or turf. Peat or turf is used throughout Europe generally, wherein the ordinary cost of its production is not materially increased by cost of transportation. In the large and small cities, as well as in the country districts, it is used for fuel; in fact in many localities it is the only substance used for heating purposes Peat is the product of decayed organic matter. The main cause of the transformation of vegetable substances into peat is water of a certain composition and temperature, which, being almost still or flowing slowly in or above the earth, permits of the development of swamp plants, and, at the same time, preserves the latter from total decomposition, by reason of exclusion of the air. These conditions are found to exist more particularly in the temperate zone, where the necessary variations of temperature occur, and where tracts of land are found whose impervious beds lead to continual accumulations of water, while, on the other hand, other portions of territory with loose and penetrable beds, especially in regions inundated by the overflowing of rivers, are subjected periodically or continuously to an extraordinary saturation. The various theories that have heretofore been advanced to account for the origin and development of peat bogs generally agree that the moors are the product of a more or less extensive decay of certain plants in a mass of vegetation which, under favorable conditions as regards locality, climate, and moisture, is continually being renewed in one section and matured in another. The upper layer of peat or turf, which consists for the greater part of varieties of moss, is, when broken into fragments, a loose fibrous substance—a mixture of root fibers, leaves, stems, etc. The bottom layer, known as pechtorf or specktorf ("pitch turf"), consists of a black, compact, pitchy mass, which shrinks rapidly on being separated into small pieces.

It has, when cut evenly, a smooth, wax-like surface, contains the greatest amount of nitrogen, and, consequently, is the most valuable for heating purposes. Every rational operation of peat bogs or moors must be begun by the draining of the territory to be worked, and this draining must be undertaken sufficiently in advance of the working of the peat moor itself, in order that the territory in question may attain the requisite degree of dryness. Even after this has been effected, the peat still contains water in quantity equal to from 70 to 80 per cent of its weight, and this remaining moisture is then almost entirely removed by successive processes of drying in the air, manipulation with machinery, or subjection to artificial heat. Until within the last few years, manual labor has been employed to work the peat bogs, but a very ingenious machine has recently been invented to take its place. This machine consists of three lancet-like knives, which, by operation of a toothed rod, cogwheel, and crank, are sunk into the peat, cutting out a square piece, which is received upon a horizontally working shelf and removed by a simple reversing of the above-mentioned contrivance. Another method consists in plowing and harrowing the bog or moor by the use of steam power and wire cables, the material for which is manufactured at Mannheim. The process of drying the peat or turf, in so far as small moors are concerned, consists simply of exposure to the open air. When extensive territories are worked, artificial drying is resorted to, and the expense involved in the latter operation is by far the greatest incurred in the production of peat. In Germany the following kinds of peat are known: Cut peat, which is cut into the form of bricks by hand spades or special machines; moulded peat, which is produced by cutting the peat moss into irregular pieces, mixing it with water and then moulding it into the respective forms; machine or pressed peat, which is the result of pressing the turf, after previous separation into pieces and drying in ovens. In the category of "machine peat" is also included the so-called "ball peat" (kugeltorf)—globes of turf about four inches in diameter, made by passing the turf pulp through specially contrived appliances. In the district of Bamberg, the moor to be worked is first freed from vegetation, leveled, plowed, and harrowed, and the loosened peat broken, so as to be exposed to the action of the air. It is then gathered by means of a kind of snow plow, brought to the separating machine, taken thence to the drying oven and the press, whence it issues in the shape of smooth, shiny, dark brown bricks. A machine in operation at one of the chief peat works in Germany produces, provided suitable material is used, from 10,000 to 15,000 bricks in ten hours. Another machine, requiring six horse power to work it, can produce from 60,000 to 100,000 bricks a day. In Germany the relative cost of peat as compared with hard coal is as follows: One hundred kilogrammes (kilogramme=2·2 lb.) of good Zwickau hard coal cost at the mine 1·20 to 1·62 marks (mark=1s.), while the cost of production of the same quantity of peat amounts to from 0·30 to 1·40 marks, according to quality. Besides its use as fuel, peat is turned into account in Germany as a fertilizer and as building material, it being successfully used as a filter for vacant spaces, separating layers for waterworks, reservoirs, ice houses, etc. By means of a process patented by a tanner in Mayence, it has also been made to do service in tanneries. The waste or superfluous particles of peat, known as peat dust, have recently been brought into extensive use as a material for fitting up and preserving odorless vaults, an innovation, says Consul Stern, deserving strong commendation, especially in localities where the sewerage is inadequate. Hanover and Mecklenburg alone have from 140 to 150 square miles, and Bavaria has 22 square miles of peat moors.

### APPROACHING ECLIPSE OF THE MOON.

A partial eclipse of the moon will occur on the night of September 14, 1894. It will be visible throughout North and South America. The beginning will be visible in the western part of Europe and Africa. The accompanying diagram will give the reader some idea of the moon's course as it passes by the earth's shadow. The large shaded circle represents a cross section of the earth's shadow, and the small circles represent the moon at first and last contacts and middle of eclipse. The moon will pass by the lower edge of the shadow, touching it first at the southernmost point. The observer will therefore see the shadow first at the north point of the moon's disk. As the moon moves up toward the left, the shadow will appear to move down toward the right, covering at the middle of the eclipse a little less than a quarter of the diameter of the moon's disk, and leaving it at a point 58° to the west from the north point. The first contact will occur at 9 h. 36 m., central standard time,

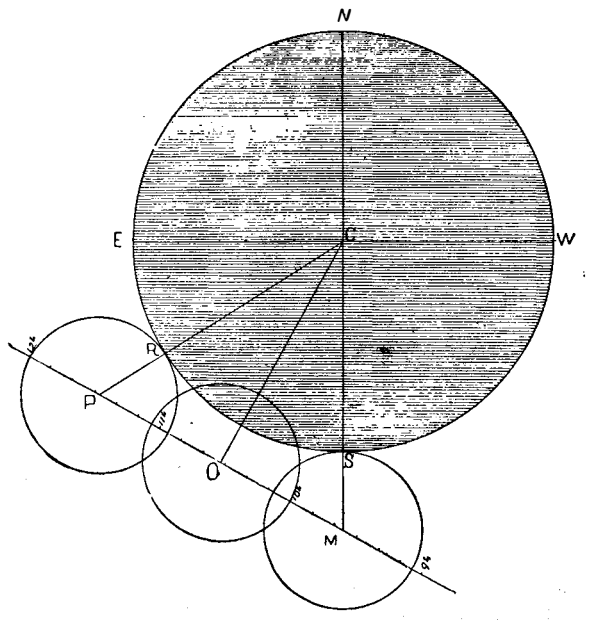


DIAGRAM SHOWING THE COURSE OF THE MOON BY THE EARTH'S SHADOW DURING THE PARTIAL ECLIPSE, SEPTEMBER 14, 1894.

the moon's center being then at the point M. Before this a faint shading, due to the penumbra of the earth's shadow, will have been noticed on the upper part of the disk. At 10 h. 32 m. the moon will be at O, and the eclipse at its maximum. At 11 h. 28 m. the moon will be at P, leaving the shadow at R. After that there will be only the faint penumbral shading on the west side of the disk.

A total eclipse of the sun will occur September 28, 1894. It will be invisible in America. The path of totality passes across the Indian Ocean. The eclipse will be partial in Africa, Persia, Hindostan, and southern Australia. The times marked on the chart are expressed in Greenwich mean time.—Astronomy and Astro-Physics.

### Flag Making for the Navy.

The flag lockers of a modern cruiser contain more than 200 ensigns, and in this country, according to the Marine Review, they are made in the flag room of the equipment building at the Brooklyn navy yard. The flags of many nations are of most elaborate design, and composed of every color known to the flagmaker's art; others are severely plain, but all have to be mathematically correct as to size, color, and proportion. Our own flag is a difficult one to make correctly with the forty-four stars in its blue field and have them accurately arranged. Each star must occupy its correct position and not deviate a quarter of an inch, that the symmetry of the union be preserved.

In constructing flags eight colors are used. They are red, white, blue, yellow, green, brown, black, and lately canary yellow has been added. The yellow first mentioned is rather of an orange tone. The canary shade was adopted to take the place of white in signal flags, as at a distance it was found that the white blended in with the horizon and made the accurate reading of a signal almost impossible; in consequence the Navy Department has recently ordered the change. The brown bunting is used to typify bronze, and is used quite extensively in the more elaborate foreign flags.

The largest flag made for our navy is the American ensign No. 1. This has a fly of 36 feet and a hoist of 28·9 feet. It is a flag that is rarely made. The cruisers Brooklyn and Minneapolis will be the only vessels of our navy to carry it. The flag borne by all our other ships is the No. 2, which is 27·19 feet long and 14·35 feet wide, and is the chief standard of the man-of-war. In this flag the side of the blue field in which the stars are placed is four-tenths the length of the fly, and in the same manner the size of flag and field is designated for every flag from the No. 2 down to the No. 8, which is only 4½ feet long and 2·67 feet wide.

In the Brooklyn yard flag room are made flags of forty-four different nations, two sizes for each. The No. 1 is 34·86 feet long and 13·12 feet wide. The No. 2 is smaller. The United States flag is given to our cruisers in seven sizes for use in various parts of the ship and in small boats and on various occasions. All the bunting used is of American make and comes from either the United States Bunting Company or the New England Bunting Company, both of Lowell. About 50,000 yards are used every year, and to guard against any possible defects in its manufacture, each piece is put to a rigorous test. Severe tests are made for fast color. A generous clipping is steeped in fresh water for twenty-four hours, after which it is vigorously scrubbed with soap, and when thoroughly rinsed out is dried in direct sunlight for eighteen hours. Bunting that will withstand all this is considered fit to be put into Uncle Sam's flags.

The most difficult flags to make are those of San Salvador and Costa Rica. The first is very elaborate and requires all the colors, and the second is not less elaborate and takes every color but brown. The intricate designs are cut out by means of zinc patterns. The American ensign is a comparatively plain flag. By aid of copper patterns the stars are cut out with chisels from muslin folded thirty times. The chisels are of various sizes for various stars, and only ten cuts are required to cut every thirty stars.

### Weight and Horse Power of Rain.

One inch of rain falling upon an area of one square mile is equivalent to 2,323,200 cubic feet, or nearly 17,500,000 gallons, and this quantity of water will weigh 145,200,000 pounds, or 72,600 short tons. If one inch of rain fell over the entire area of the city of Philadelphia, 129 square miles, the quantity of water which would be precipitated would be represented by 2,250,000,000 gallons, or 18,730,000,000 pounds, or 9,365,000 short tons. Therefore the quantity of water represented by one inch of rainfall distributed over 24 hours falling upon the area of Philadelphia would be nearly ten times the maximum pumping capacity of all our waterworks engines for a day, and is more than twice the total capacity of all the reservoirs now connected with the city water supply. Professor Loomis gives the average height of clouds as about two miles, and as the aqueous vapor always present in the atmosphere is suspended for a considerable time and carried for great distances by winds, it is highly probable that the great majority of the water which falls as rain has been elevated by the sun to a height approximating 10,000 feet. While it would be fair to assume this figure in calculations, there may be objection to it on the ground that the clouds from which much of our rain is precipitated are not more than a half mile above the earth, and, therefore, a height of but 3,000 feet will be estimated for, but those who desire to assume the greater elevation can readily calculate what the figures would be for 10,000 feet. As above shown, the weight of one inch of rain upon one square mile is 145,200,000 pounds; multiplying this by 3,000 feet for the height, and dividing by 60 on the assumption that this inch of rain fell in one hour, we have as a result 7,260,000,000 foot pounds representing the amount of work done by the sun per minute if the water was raised as rapidly as it fell. This is equivalent to 220.000 horse power. If pumping machinery worked at the low economy of 2 pounds of coal per horse power per hour, or if the pumps gave a duty of 100,000,000 foot pounds, 200 gross tons of coal would be required to raise to a height of 3,000 feet the water represented by one inch of rain on a square mile; now multiplying this by 129 to represent the area of Philadelphia, we have 28,380,000 horse power and a coal consumption of 25,800 long tons —Mr. John Birkinbine, before the Engineers' Club of Philadelphia.

A SYSTEM of electric lighting is being put in at Juneau, one of the best known of Alaskan settlements —a place of 2,000 inhabitants. When completed this will be the first central electric light plant in the Territory. Electricity, however, has been used for some time in a limited way in the Alaska mines. Water power is abundant everywhere, and the current is generated on the streams and carried to the mines by cables.

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### PROFESSOR CHARLES VALENTINE RILEY.

The name of Professor C. V. Riley is a familiar one to our reader. He appeals to them as the author of some of the most interesting papers which we have published in the SCIENTIFIC AMERICAN and SUPPLEMENT, and many of our readers are under special obligations to him for the work he has done in solving problems of entomology. In the scientific world it may be said that no entomologist stands higher than he. His career is of special interest as showing the typical self-made man whose life is identified with America, and whose first steps, after his school and college days, were taken on the farm and in the service of the press.

Charles Valentine Riley was born in London, September 18, 1843. His early life was spent in rural England, much of it in the pretty village of Walton-on-the-Thames, between Hampton Court and Windsor. At the age of 11, he entered the College of St. Paul, Dieppe, France. After three years' attendance there he spent three years more in a private school in Bonn, Prussia.

Even in these early days his talent for drawing was noticeable, and curiously enough, as an indication of the future, he had a great fancy for producing exquisite delineations of butterflies, moths, and other insects. While his drawing teacher, Professor A. Hoe, was urging him to repair to Paris and devote himself to art, he was by family circumstances thrown upon his own resources, and at the early age of 17 he sailed for America, went West and settled with Mr. G. H. Edwards, Kankakee County, Illinois, on a stock farm.

Three years were spent here, years during which the boy was distinguished by his love of work and by a most marked tendency for original research, which took the direction of the improvement of farm processes and of farm stock. Those who know him say that there is but little doubt that he would have made a mark as an advanced agriculturist, had not his health failed him under the great strain, so that at the age of 20 years he went to Chicago. Here he had his early trials. He actually worked in a pork packing establishment, made portraits of his fellow boarders, and made sketches which he personally sold to appreciative purchasers. At last he obtained an engagement as a reporter on the Evening Journal, and next changed to the Prairie Farmer, at that time the leading agricultural paper of the West. His especial department was botany and entomology, and in the interest of that department he traveled extensively. His enthusiasm, industry, and versatility soon made his services invaluable. A curious illustration of the bent of his mind is shown in the fact that he here learned typesetting, simply because he was determined to have some trade at his command. The development of insects was one of his main studies, and the results of many original investigations and the answers to many inquiries were published by him in this paper.

In May, 1864, he enlisted in the army, serving for six months with the 134th Illinois Volunteers. The regiment disbanding six months later, he returned to his paper, severing his connection with it in the spring of 1868 to accept the office of State Entomologist for Missouri. At last we find him fully launched upon his career, and from 1868 to 1877 he did the work which firmly established his international fame.

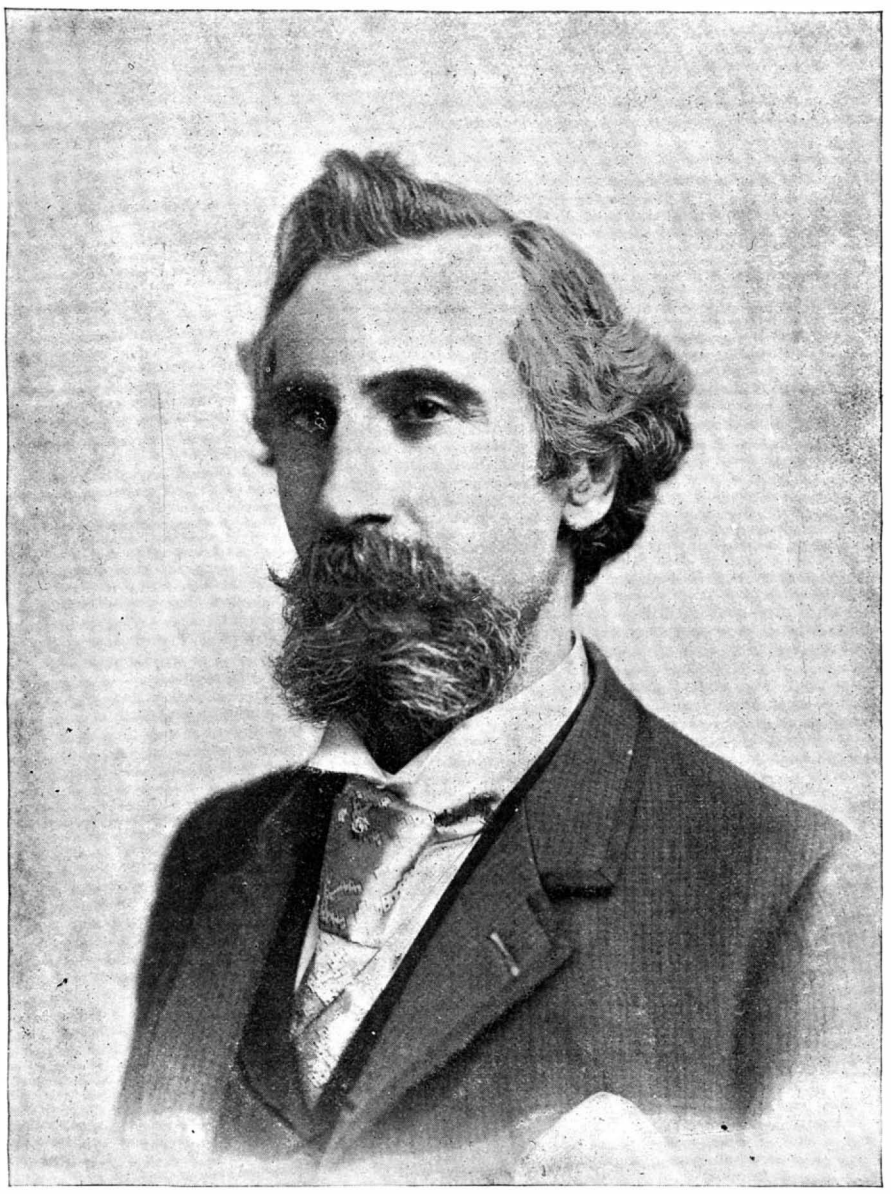
His salary was but $3,000 per annum and there was no allowance for expenses, yet out of this amount Prof. Riley paid his assistant and large traveling expenses. He also paid for the beautiful illustrations of the reports, which illustrations were drawn by himself. The original edition of the reports have been long exhausted, and any copies now bring very high prices. Charles Darwin, the famous naturalist, gave them the highest encomiums. In connection with Mr. B. B. Walsh, Acting State Entomologist of Illinois, Prof. Riley established the American Entomologist about this time.

In 1873 a bill was passed creating the United States Entomologic Commission, with Prof. Riley as chief, and Dr. A. S. Packard, Jr., and Cyrus Thomas as his associates. This commission was designed to cope with the Rocky Mountain locust, then doing great damage, and in the five years of its existence published five large, fully illustrated reports, besides seven bulletins, all the work being done by the three members.

Since this period, with an intermission of two years, Prof. Riley has held the position of United States Entomologist, which he resigned a few weeks ago. His work at Washington has fully upheld the promise of his early years. In carrying on the operations of his department, working night and day, year after year, without rest, he nearly ruined his constitution. To the National Museum he presented his magnificent private collection of insects, representing the labor of twenty-five years. With it as a nucleus he built up a collection unsurpassed in America.

Applied entomology or economic entomology, as it is sometimes called, has been his specialty, and he in some sense is the founder of that science. Space is not at command to even summarize his work. After his studies on the Western locust problem, he took up the animals affecting stock in the lower Mississippi, those affecting the hop industry and cranberry growers, and in all those lines he did useful and practical work, ameliorating greatly the troubles of the farmer.

In the past few years, two of his studies have produced epoch-making results. One is his famous emulsion of kerosene oil, milk or soap solution being the emulsifying agent. Having found that this was an infallible insecticide, he had to devise means for applying it, and invented the "cyclone," "eddy chamber," or "Riley system" of nozzle for spraying it upon trees.



PROFESSOR CHARLES VALENTINE RILEY.

Another of his achievements was the introduction of the Australian ladybird, Vedalia cardinalis, into California, to destroy the white scale, which was then ruining the orange groves. The result was simply magical. Since then the insect has been introduced elsewhere. It is interesting to note that other attempts of the same sort that have been made in California, against other insects, either against his advice or without his indorsement, have not had the same success. His discoveries in relation to the phylloxera alone were enough to give him international renown, and his recommendations have been followed by grape growers in all parts of the world. He has been a most voluminous writer; a bibliography of his writings, published by the Department of Agriculture, five years ago, showing over 15,000 titles.

It would take much space to give the simple list of the honors in the way of medals and diplomas, honorary memberships of societies and the like which have been showered upon him. One of his greatest honors was the gold medal presented him by France in 1873, in appreciation of his services in the study of the phylloxera. His work will live. His organization of the Entomological Department of the United States government will be responsible for much of its value and utility in the future, and lands as far apart as Egypt, the Sandwich Islands, California and France are today reaping the benefits of his work. His resignation from the Department of Agriculture is to be lamented as a national loss, brought about by his absolute need for rest and by other causes affecting his professional work. It is believed that the vacation which he has at last given himself may be productive of the most important results to humanity in the direction of his favorite science.

As a lecturer his reputation is extended. He has held appointments as lecturer on entomology at Cornell University, Kansas State Agricultural College, Missouri State University, and the St. Louis Washington University. He has also lectured before the Boston Lowell Institute and the Brooklyn Institute. He edited the 5th volume of the Reports on the Paris Exposition of 1889, a work of nearly a thousand pages, with text, figures, and plates, a work containing a mine of valuable information on agriculture and agricultural education, not only of foreign countries, but of our own. So much of his writing has taken the form of monographs and addresses, and it embraces so many titles, that it cannot be summarized here.

### Not a Deadly Current.

The Electrical Review says: "The well authenticated report of an instructive electric accident comes from Paris. A workman was caught between two bare wires, which conducted the current from the electric plant to the railroad station on the Seine. It was at first not known what caused the disturbance noticed in the current, and when it had lasted five minutes the current was cut off and an inspection of the conducting wires made. After ten minutes' search it was found that a workman had been caught between the two wires and had received the discharge of 5,000 volts for the time of five minutes, while ten minutes later he was found apparently dead. At once attempts were made to restore him, first by artificial respiration after the usual methods, but this being of no avail, the rhythmical pulling of the tongue was resorted to, and this was successful in very gradually restoring respiration, after which the man made a quick recovery and was none the worse for his bitter experience, except that he suffered much from the burns where the wires had touched his skin.

"Dr. D'Arsonval, who reported the case to the Biological Society, of Paris, concludes from this that death from electricity is not immediate, but that the first effects of the electric current are asphyxia and syncope, the result of arrested respiration, and that when this is re-established by proper treatment, the apparently suspended vitality may be revived.

"Dr. D'Arsonval adds that 'if this is so it becomes doubtful if the criminals who are executed in the State of New York are killed by electricity or are killed by the autopsy.'

"It appears from the above case that if treatment for asphyxia was substituted for the autopsy, some of the condemned criminals might be revived even when they have been submitted for five minutes to a current of 5,000 volts and had been lying apparently lifeless for ten minutes."

We would remind our excellent contemporary that in every case of execution by electricity in this State, the body of the victim is carefully examined by medical experts and pronounced dead before the autopsy.

### Chromium.

A communication made to the Academie des Sciences, by M. Henri Moissan, contains some new and interesting researches respecting the metal chromium. By availing himself of the intense heat produced by the electrical current, he succeeded in preparing cast chrome in a very small quantity, which may be fairly represented by the formula C Cr. When treated with lime or the double oxide of calcium and chrome, the metal produced under these conditions is more infusible than platinum, and takes a very fine polish. It is, moreover, not attacked by atmospheric agents, not to any great extent by acids, and resists the action of aqua regia and of alkalies in fusion. This preparation of chrome leads to some important results in connection with the alloys of the metal. Alloyed either with aluminum or copper, it possesses some remarkable qualities. When pure copper, for instance, is alloyed with 0·5 of chrome, it becomes endowed with a double power of resistance, is susceptible of a high polish, and undergoes less change when exposed to atmospheric influences than when in a condition of purity.

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### Submarine Navigation.

The Electrical Review, London, says: "All the maritime nations are concerned with, and we believe are studying, through the media of their Admiralty officials, the problem of submarine navigation. It is considered that a navy equipped with vessels which can be propelled at any depth beneath the surface of the water will possess enormous powers of offense. France, Germany, Italy, Spain, Great Britain (of course), and even Turkey, are at present engaged with the greatest secrecy in endeavoring to produce a practicable form of submarine topedo boat; but the problem has hitherto baffled them. It is true that some success attended the famous trials of the Gymnote in Toulon Harbor about two years ago, and it is claimed that the French have a boat, the Gustave Zede, which is capable of keeping up a speed of 14 knots for several hours below the surface of the sea; but these boats can hardly be said to have realized all the necessary conditions. From what we can gather, the key to the whole problem is in the hands of electrical engineers. Steam cannot be employed as a motive agent on account of the absolute impossibility of disposing of the products of combustion. Compressed air gives no better results, the weight of the chambers in which it must be stored proving too great; moreover, to dry the air thoroughly and the expansion of the necessarily enormous amount so lowers the temperature that ice forms in the pipes and renders them useless. Undoubtedly the direction in which progress and indeed success must be looked for is in electricity, more especially in the use of storage batteries. As yet, however, no system of accumulators has been discovered that is perfectly adapted to the needs of submarine navigation. Here, then, is a problem which those who are interested in secondary batteries may study, possibly with profit to themselves. The absolutely essential points are extreme lightness, considerable storage capacity and the absence of noxious gases at the moment of discharge. These must be borne in mind when entering upon a line of investigation. They are difficult points to reconcile among themselves to say nothing of the conditions; but we venture to think that difficulty need not deter. If discouragement followed upon the recognition of the arduous nature of a problem, how few would ever have been solved by electrical engineers.

### Power and Speed in Cotton Mills.

BY FRANK P. SHELDON.

Taking a general view of the entire mill, a comparison between the old and modern mills is striking. Going back to the time when both warp and filling were spun on mules (1869), my data show that what was then a good average mill of 44,000 spindles, all mules, was producing 37,700 pounds per week, and required 677 horse power to drive it, a product of 0·85 pound per spindle per week and of 55 pounds per horse power per week.

Another, with 28,000 spindles, all mules, produced 24,300 pounds per week, with 430 horse power, or 0·87 pound per spindle per week and 56 pounds per horse power.

Another mill (1874), with old ring warp and mule filling, with 90,000 spindles, produced 78,000 pounds per week, and required 1583 horse power to drive it—a product of 0·87 pound per spindle per week and 49 pounds per horse power per week. These were all on print-cloth numbers.

A mill with Sawyer warp spinning and fairly high-speed mules produced 0·93 pound of cloth per spindle per week, and 1 horse power produced 46·5 pounds of cloth.

And to-day a modern mill with all frames at high speed produces 1·17 pounds per spindle per week, and 1 horse power produces 46·75 pounds. In round numbers the product of a 30,000 spindle modern mill is equal to that of a 40,000 spindle mill of 20 years ago.

From these figures we find that the Swayer warp mill required 19 per cent more power to turn off a pound of cloth than the old all-mule mills. But this fact did not weigh a feather against the adoption of Sawyer spindles.

Since that period the product per horse power has not changed materially. But the improvements made in steam plants meantime have reduced the actual cost of the power per pound of cloth, so that it is less than it was in the old slow-speed "all-mule" mill, the total cost for fuel for power alone being now about 0·41 cent per pound of cloth, while then it was 0·66 cent (taking the same price for coal in both).

The deduction to be made from the above table is that in regard to cost of production alone, any increase of speed and product will be in the line of economy, so far as cost of power is concerned, even if the latter should increase four times as fast as the production; and this is so unlikely a supposition that practically the question of power is not to be considered for a moment as against speed.

One of the items of power in a cotton mill, and not a small one, is the friction load of the shafting. Power expended for this is in a sense wasted. It produces nothing and costs a great deal. In the best mills it will be not less than 22 per cent and often 25 per cent of the total power. (This includes the friction due to the belts on the loose pulleys of all the machines, as this is the usual method of weighing this load, so that it does not of course represent the mere friction due to weight of the shafting.) In a mill requiring 1,000 horse power, therefore, 220 to 250 horse power will be expended in this manner, costing, at $19 per horse power per year, about $4,200. Various methods have been tried from time to time to reduce this loss. One way has been by reducing the diameter of shafting, sometimes to extremes, and increasing the speed, but not much has been accomplished in results. The percentage remains about the same. In the course of my work I have had occasion to test the power of a large number of mills of all descriptions, old and new, large and small, with excessively heavy and excessively light shafting, at extreme slow and high speeds, and medium heavy at medium speeds, and with all sorts of bearings and in all sorts of conditions. I have found the friction load to run from 22 up to 39 per cent. The lowest I have ever found was 21·24 per cent, and this was in a very old mill, requiring 1,055 horse power, with rather heavy shafting, but all at low speeds, from 210 to 250 revolutions. The friction load was 224 horse power. I have never found this result equaled in a modern mill. Several years ago I tested two mills in the same yard, one a very old one, with extremely, even ridiculously, heavy shafting, but at very slow speeds, and the other a new mill just completed at that time, with very light shafting at high speeds, and with bearings about 5 feet apart. I remember that I expected to find the friction of the older mill so much more than the new one that it would pay to change the shafting. The test showed so little difference between the two that it was not worth considering. This result was a surprise to me at that time, but would not be so now.

So far as the theory of friction is concerned, the laws that govern the driving capacity of a shaft and its friction are so related to each other that it makes no difference in theory whether a large shaft at a slow speed or a small one at a higher speed is used to convey a given amount of power, if the speed in both cases is in inverse ratio to the cubes of their diameters. But in a cotton mill this theory will not hold in practice. Increasing speed of the shafting is liable to increase the friction, and for obvious reasons. The friction of shafting in cotton mills is not due entirely to its dead weight, but more to the lateral stress of the multitude of belts on machines and counters. This stress is independent of the weight of the shaft and has no relation to it, and reducing its diameter will not affect it. On the other hand, when we reduce the diameter and increase the speed to give the same power, we decrease its circumference or rubbing surface only as the diameter, while we increase its speed inversely as its cube. Therefore, we have increased the surface velocity in the bearings inversely as the square of the diameter. And although the weight of the shaft is also reduced in the same ratio, yet the lateral stress of the belts is put upon the rubbing surfaces at the above greatly increased velocity. The friction, therefore, ought to be more, and I am satisfied that it is, other things being equal. Then, when in addition to this the number of bearings is increased, in order to properly support the reduced shaft, we magnify this evil, for in a cotton mill with bearings suspended from wooden beams and floors, the conditions are far from that perfection which admits of the strict application of any mechanical formulas. Every unnecessary bearing increases the chances for greater friction. In lines which are merely carriers of power, with no pulleys or belts upon them, the above objections to high speed do not apply so forcibly up to a certain point. The fact is, in this as in all other mechanical constructions, it is impossible to apply any strict formulas. They must be materially modified by the carefully noted results of experience.

In the mill where I found the friction 39 per cent the shafting was rather heavy, but not extremely so. I attributed the excessive friction here to the multiplicity of bearings, and all of a very bad construction, the boxes being absolutely rigid. Of course, the difference between 39 per cent and 22 per cent is worth saving. It would represent 170 horse power on a mill requiring 1,000 horse power, and this would represent a needless loss of $1,700 a year for fuel alone in the best steam mill. And, more than this, in some cases of partly water and partly steam power mills, it may mean the still larger losses from stoppage of machinery or loss of speed, which might be overcome merely by reducing the friction down to a reasonable point. This was, in fact, exactly the case in the mill in question, which I tested recently on account of this condition of things.

High speed of shafting in carding and weaving rooms is especially to be avoided. I have in mind a large mill in which the shafting in these rooms runs over 320 revolutions. The loom pulleys are 5 to 6 inches diameter, the belts very tight. Of course, the shafting is very small, with bearings every 5 feet, and in one room with 384 looms there are over 500 bearings, whereas half that number, with a proper arrangement, would have sufficed. Every one of these 250 unnecessary bearings means more or less unnecessary friction. In yarn mills the friction is, of course, less than in weaving mills. I have found it about 18 to 19 per cent.

Carrying steam to a number of small engines distributed about the mill was once suggested, I believe, in a certain mill, but, of course, is not to be thought of. At present the only thing to do is to avoid extreme speed, use bearings of good construction and in as small number as possible, and by a good arrangement keep the friction down to as low a point as possible.

Although I have emphasized the supreme importance of high speed of spindles and the reliability of the motive power, rather than a fine economy of fuel, yet it, of course, goes without saying that this economy is to be sought also by every practicable method; and all improvements in steam engineering to this end are to be welcomed, so long as they do not raise any question as to the more vital point in cotton manufacturing—certainty of continuous operation.—Manufacturers' Gazette.

### The Campania.

The new Cunard steamer Campania has just broken both the eastward and westward records by crossing the Atlantic in 5 days, 9 hours and 29 minutes. This was on her westward trip, ending in New York August 17. The previous record was held by the same vessel for her eastward trip, last November, which she accomplished in 5 days, 12 hours and 7 minutes.

The days' runs were as follows:

| | | |
|---|---|---|
| August 12 | 516 | knots. |
| " 13 | 528 | " |
| " 14 | 543 | " |
| " 15 | 525 | " |
| " 16 | 515 | " |
| " 17 | 126 | " |
| Total | 2.783 | " |

The average distance traveled a day was 515·8 knots, and the average speed per hour was 21·49 knots.

It is very doubtful if any ship now in commission in the United States navy, or building, could maintain an average speed of 21·49 knots per hour for days at a time. When the new vessels of the American line, now building, shall be put into direct competition with the Campania, Lucania, Teutonic, and Majestic, we may expect some extremely interesting voyages.

### An Electrical Fire-damp Detector.

It is a well known fact that a spiral of platinum wire that has been heated to redness glows more brightly when it is plunged into a vessel containing air mixed with inflammable gas. This forms the basis of a method of detecting fire damp in coal mines, which has been worked out by G. Fletcher. The method involves the use of an instrument, which consists of two identically similar spirals of fine platinum wire, one of which is inclosed in an air tight tube containing air, and having the upper end glazed, while the other is contained in a similar tube of wire gauze, which is also glazed at its upper end, both tubes being arranged vertically. When a current of electricity is passed through both spirals in air, they glow with equal brilliance; but when the instrument is introduced into an atmosphere containing inflammable gas, the spiral in the wire gauze tube glows the more brilliantly, the brilliancy being proportional to the amount of inflammable gas present. By an ingenious arrangement it is possible to calculate very easily the actual percentage of dangerous gas that happens to be present. This arrangement is based on the principle used in common photometers. Any small storage battery, such as those in use for miners' lamps, may be used as the source of electricity.

### A Church Rich in Silver.

The St. Louis Globe-Democrat says: The erection of the magnificent canopy over the high altar of Our Lady in the shrine of Guadalupe, Mexico, has been completed. The pillars to support it are each of a solid block of polished Scotch granite weighing seven tons. The diameter of each pillar is 3 feet, and the height 20 feet. The altar will be ready for dedication December 12 (Guadalupe day), and will be the most elaborate and costly one in America. The additions to the church edifice will not be completed for nearly two years at the present rate of progress. When finished, the shrine of the Lady of Guadalupe will be one of the notable Catholic church edifices of the world. The solid silver altar railing weighs twenty-six tons, and many millions of dollars are in other ways represented in the palatial place of worship.

### Glycerine in the Treatment of Coughs.

The Medical Reporter, of Calcutta, says that in severe paroxysms of coughing, from whatever cause, a tablespoonful of glycerine in hot milk or cream will give speedy relief. If any of our readers are disposed to try it, we would caution them that the dose of glycerine seems rather large, especially as nothing is said about the patient's age or the frequency of its repetition.—N. Y. Medical Journal.

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## RECENTLY PATENTED INVENTIONS.

### Engineering.

LOCOMOTIVE BOILER.—Elmer C. Jordan, Sacramento, Cal. The boiler may be of the usual construction, having at its front end the fire hole through which fuel is introduced to the fire box, and the invention consists principally of a box-like frame on the under side of the boiler, having at its under side an air opening from which air passages lead to a top opening and to the fire hole in the boiler end, whereby heated air will be supplied to the fire box for insuring more perfect combustion and saving of fuel.

METHOD OF CARBURIZING IRON.—Jean Meyer, Dudelingen, Germany. According to this invention molten pig iron is subjected to carburization directly in the casting ladle by introducing a carburizing substance to produce steel of any desired degree of hardness. Briquets of pulverized coal or coke and lime are so prepared that their substance may be dissolved immediately and regularly and distributed throughout the mass of molten metal, the moment of their introduction being so chosen that the reaction of the carburization is completely terminated before pouring the metal from the ladle into the ingot moulds.

### Railway Appliances.

CAR FENDER.—Robert Thomson, Brooklyn, N. Y. This is designed to be a simple and practical device, well adapted for ready and secure removable attachment upon either end of the car, affording when in place an adjustable and yielding apron that will pick up any one who may be in front of a car in motion, without injury, and affording safe support to the person until the car is stopped. The top of the main fender frame is covere with elastic woven wire fabric secured upon a border frame at the front of which is a semitubular elastic cushion piece, the latter absorbing a portion of the force of concussion and preventing fracture of the lower limbs, while similar tubular elastic guard pieces prevent the party struck from rolling off at the sides.

### Miscellaneous.

GLASS CARRYING TRUCK.—Robert M. Roberts, Anderson, Ind. The bed of this truck has at each end a vertical standard with cushioned arms to carry glass cylinders, a wheel being arranged beneath one end of the bed, and leaf springs secured to the bed journaled on the axle of the wheel, while there are supporting legs at the other end of the bend. The invention is an improvement in vehicles for carrying glass cylinders from where they are blown to the place where further work is to be done on them, and provides for the safe support of the cylinders without their being excessively jarred. The vehicle has sufficient capacity to carry quite a large number of cylinders.

GLASS STRUCTURE.—Edgar W. Cunningham, Jersey City, N. J. To provide a coupling between overlapping panels or panes of glass is the design of this invention, one which is simple and conveniently applied, and which will keep out water or moisture. It consists of two spring leaves, one below the other, having a water-tight connection at one point, with a gutter at the connection portion of the leaves and an apertured flange at the free end of one of the leaves. The device is designed to facilitate the construction of roofs of conservatories, or their sides, or any portions where panes or panels of glass are to overlap. Expansion and contraction are provided for, as well as the ordinary unevennesses and irregularities of the glass.

LUNG POWER TESTER AND DEVELOPER.—John R. Hanlon, Pennington, N. J. The tube to be blown into, according to this invention, is connected with the upper end of a threaded pipe held in vertical supports, and on this pipe screws a nut on the upper end of an inverted T-shaped pipe, the branch arms of the lower ends of which have at their ends apertured heads. Air passing from the tube which is blown into passes through the inverted T-pipe and out of the opposite heads, giving a turning motion to the pipe, and carrying down the nut, which serves as an indicator on a graduated scale at the side.

MEASURING TANK.—Owen James, Scranton, Pa. This tank has an inclined bottom in the lower portion of which is a discharge opening, with valve and valve rod, an air vent leading from the opening to the top of the tank, and a measuring vessel is arranged directly beneath the tank chamber and forms a permanent attachment thereto. The construction is simple, the tank may be readily cleaned, and permits the convenient drawing and accurate measuring of the contents, it being adapted to contain oil, milk, or other liquids for dispensing at retail.

VEHICLE AXLE.—William L. Massengale, Deatsville, Ala. The axle spindle, according to this invention, is made in two sections, one having a dovetail rib and the other a dovetail groove to receive it, the lower section having also a tongue adapted to enter a recess in the body of the axle and clips locking the tongue to the axle body. It is designed that with this construction worn spindles may be restored to proper shape without the necessity of cutting the axle or reforging or reworking the spindle, the work not calling for the employment of skilled labor.

PURSE FRAME.—Scheyer Nathan, Brooklyn, N. Y. This frame is of spring material, so made that one member may be sprung endwise past the other, opposing latches inside interlocking and opening by laterally forcing one from the other, while coiled springs on the pivots bear on the frame members and the frame opens when the latches are disengaged. The locking device is thus entirely concealed within the frame, and the opening may be readily effected with one hand.

WHEELBARROW.—Auguste Taufflieb and Victor Chaussard, Issoudun, France. This is an upturning barrow, whose body is pivoted to the wheel axis and is raised by the action of a dog, which at the desired moment becomes connected with the periphery of the wheel and upturns the body of the barrow in a forward direction. The upturning mechanism can be applied to any kind of a barrow having one or more wheels, as well as to trucks, and so as to upturn the body either toward the front or the side of the road.

FOLDING BOX.—George H. Savacool, Newton, N. J. This is a strong and inexpensive box designed to hold ice cream and similar semi-liquid substances, but which may be folded flat so as to be conveniently shipped, may be easily and quickly set up, and has a cover adapted to fold tightly into the box. It may also be used as a packing box to hold a variety of substances.

BOOK HOLDER FOR READING STANDS.—Francis J. Anderson and William M. Irick, Gainesville, Texas. This holder is especially designed to receive large books of reference, such as dictionaries, etc., the mechanism of the holder providing a cradle for the reception of the book, the cradle to be carried upward and outward to bring the book in proper position for consultation, and also acting to lower the book without jar or injury. The cradle has pivoted sides, which may be locked in position to keep the book closed, or fully opened and supported in open position.

LANDING NET.—Allan Holmes, Dunedin, New Zealand. This is an angler's net, with collapsible frame pivotally connected with the pole in such manner that it can be quickly swung back onto the handle, making it more convenient to carry. The net is of very simple construction, and may be swung into position or folded back without detaching any of the parts or employing shifting devices, the frame swinging to its extended position by tilting or holding the pole with its front end downward, when it is automatically locked in such position until released by hand.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention. and date of this paper.


## SCIENTIFIC AMERICAN BUILDING EDITION.

**SEPTEMBER, 1894.—(No. 107.)**

TABLE OF CONTENTS.

1. An elegant plate in colors, showing a Colonial residence at Portchester, N. Y., recently completed for Geo. Mertz, Esq. Two additional perspective views and floor plans. An attractive design. Mr. Louis Mertz, architect, Portchester, N. Y.
2. Plate in colors showing a residence recently completed for R. H. Robertson, Esq., at Southampton, L. I. Two perspective elevations and floor plans. A picturesque design and an admirable model for a seashore cottage. Mr. R. H. Robertson, architect, New York City.
3. Residence of Frederick Woollven, Esq., at Rosemont, Pa. Two perspective elevations and floor plans. A neat design in the Colonial style. Cost complete $4,800. Mr. J. D. Thomas, architect, Philadelphia, Pa.
4. A cottage at Roger's Park, Ill,, recently erected for Edward King, Esq. Two perspective elevations and floor plans. A unique design. Mr. Geo. W. Maher, architect, Chicago, Ill.
5. Cottage at Hollis, L. I., recently completed for the German-American Real Estate Co. Two perspective elevations and floor plans. Cost complete $3,200. Mr. Edward Grosse, builder, same place.
6. Perspective elevation with ground plan of Saint Gabriel's Chapel, recently erected at Hollis, L. I. A unique and most excellent plan for a small chapel. Cost complete $6,500. Mr. Manly N. Cutter, architect, New York City.
7. Two perspective elevations and an interior view, also floor plans, of a residence recently erected at Orange, N. J., for Homer F. Emens, Esq. Mr. Frank W. Beall, architect, New York City. A pleasing design in the Colonial style.
8. Perspective elevation and floor plans of a cottage recently erected at Flatbush, L. I., for F. J. Lowery, Esq. Cost complete $4,600. Mr. J. C. Sankins, architect and builder, Flatbush, L. I.
9. A residence at Yonkers, N. Y., recently completed for Mrs. Northrop. A very unique design for a hillside dwelling. Perspective elevation and floor plans. Messrs. J. B. Snook & Sons, architects, New York City.
10. Club House of the Sea Side Club, Bridgeport, Conn. A good example of Romanesque style. Perspective elevation and floor plans, also an interior view. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn.
11. A residence at Hinsdale, Ill., recently erected for C. E. Raymond, Esq., at a cost of $7,000 complete. Perspective elevation and floor plans. Mr. J. H. Shannon, architect, Hinsdale, Ill.
12. The Castle of Bonnetable. Half page engraving.
13. Miscellaneous Contents: Tne irrigation of laws, illustrated with two engravings.—Viaduct for street railways, Cincinnati, Ohio, illustrated.—The fireproof building construction of the New Jersey Wire Cloth Co., illustrated.—Silvester's remedy against dampness.—Palmer's "Common Sense" frame pulley.—"The Old Hickory Chair," illustrated.—An improved hot water heater, illustrated.—The Caldwell Tower, illustrated.—The American Boiler Co.—The "Little Giant" floor clamp, illustrated.—The Akron air blast furnace.—Laundry glaze.—The "Piqua" metallic lath, illustrated.

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## Notes & Queries

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**Names and Address** must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
**References** to former articles or answers should give date of paper and page or number of question.
**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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(6204) J. D. W. writes: 1. I have nearly completed a ⅛ horse power electric motor which is about the form of an Edison dynamo. It is to run on a 110 volt circuit. The field magnet is wound with 1½ pounds No. 24 magnet wire and the drum armature with ½ a pound of No. 18 magnet wire. What size rheostat shall I use? A. Your field will only stand one ampere, which it will pass at 32 volts potential. Use two lamps in parallel with each other, and in series with the motor as a rheostat. 2. I have made an induction coil with the following dimensions: Length of core, 5 inches; diameter of core, ⅜ inch No. 16 soft iron wire; primary coil 2 layers No. 18 magnet wire; secondary coil 3 ounces No. 30 magnet wire; condenser 20 sheets tinfoil 3×5 inches. When it is attached to two 5×6 bichromate cells I could obtain only an eight inch spark from the terminals of secondary coil, but a very powerful shock. Should not the coil have given a longer spark than that? A. You need more wire on your secondary and more tinfoil in your condenser. 3. What is the best way to make a ground for a lightning rod? A. Dig a hole four or five feet deep and put a copper plate in it attached by riveting to the rod. Fill with coke rammed in. If in dry ground, it will give a poor connection.

(6205) W. M. McV. writes: We have a machine which, while running at about 5,000 rotations per minute, seems to run in almost perfect balance, but when the same machine is being started or stopped and runs at about half that speed it seems very much out of balance. How do you account for it? Can a machine rotate so fast that it will run smoothly even if out of balance? What is the mechanical way of expressing the unevenness in balance of a machine that is sometimes noticed when the machine is running at about half speed? A. There appears to be a synchronal harmony in running machinery like the relation of musical notes, that when the vibratory time conditions of an unbalanced wheel upon any shaft are greater than the number of revolutions, the wheel will show by excessive vibration that it is unbalanced, while if the revolutions are greater in number than the natural vibration of the shaft and wheel for equal times, the vibration will be overcome or suppressed, and the wheel will revolve on its own center of gravity. There is no better expression than the word "unbalanced" as applied to the vibration of revolving machines.

(6206) L. R. asks: 1. How can I form a combination from both the primary and secondary currents of an induction coil? I made an induction (medical) coil as described in No. 569 of the SUPPLEMENT and connected a tinfoil condenser with primary coil. The primary as well as the secondary coil give a strong current with a Grenet battery, but I would like to know if I can get a still stronger current by combining both, without more battery. A. You will not get as good results by the combination as with the single secondary coil connection. 2. How is a condenser connected with secondary coil? A. You can connect the terminals of the secondary to those of a condenser if you desire.

(6207) A. W. G. asks: 1. If a powerful revolving fan were placed on the deck of sailing vessel or yacht and a current of air blown against the sails, it being a dead calm, would said vessel move backward, forward, or remain stationary, fan to be open (not inclosed in metal pipe or air shaft), coupled directly to motor, or driven from belt coming from motor below. If not too much trouble, give reasons. A. The vessel would go backward, owing to the reaction of the air. 2. Can a small fan motor, wound with course wire, intended to be run with two or three cells of battery, be used (without rewinding) safely on an Edison lamp circuit? If so, can it be so arranged that current will not be wasted? A. Only by introducing resistance with a waste of over 90 per per cent.

(6208) C. W. P. asks: 1. Will you give me directions for making a storage battery that will run a 1-32 horse power motor from 6 to 8 hours? A. You should state the potential of your motor. For each square foot of positive plate in a cell allow 1-64 horse power. 2. What size wire should you use on a small galvanometer and how much should you use? A. See our SUPPLEMENT, Nos. 28, 794, and SCIENTIFIC AMERICAN, No. 23, vol. 55. 3. Will you name in their order the best conductors of electricity, the best first? A. 1. Annealed silver. 2. Annealed copper. 3. Hard copper and hard silver. 4. Annealed gold. 5. Hard gold. 6. Annealed aluminum. 7. Compressed zinc. 8. Annealed platinum. 9. Annealed iron. 4. Is there any way of reversing a motor without having two sets of brushes? If so, how do you make it and how do you connect it with the motor? A. See the SCIENTIFIC AMERICAN February 20, 1894, query 5776 for illustration and description of connections asked for. 5. What is the velocity of sound, lightning, and light? A. Sound 1,089 feet per second; light 186,300 miles per second; lightning the same as light as far as the first transmission of disturbance is concerned, but a certain time may be required for the transmission of the full stroke. 6. Is there any book that tells about making motors, batteries, and bells? A. We can supply Allsop's "Electric Bell Construction," price $1.25; Reynier's "Voltaic Accumulator," price $3; Parkhurst's "Electric Motor Construction, for Amateurs," price $1 mailed.

(6209) C. T. V. asks: 1. What causes the starting current in a dynamo? A. The residual magnetism in the cores of the field magnet. 2. What kind of electricity do human beings possess? A. They may be statically excited. 3. What causes lightning to strike bodies? A. A high difference of potential between the air and earth. 4. What kind of electricity is that generated by the dynamo? A. Dynamic. 5. Does the country in which a child is born determine its nationality? A. Yes, in most cases.

(6210) L. T. says: In paper making the following rule is used to figure the amount of paper made per hour: Multiply the number of sheets in width by 1½ and the number of feet run per minute by that result; divide that by the length of the sheet in inches, which gives the number of reams run per hour. Why does this give the desired result? A. The rule appears to be correct. The sheets in a ream divided by the minutes in an hour equals $\frac{480}{60}=8$; and the number of inches in a foot divided by 8=1½, the multiplier for the speed in feet per minute or the number of sheets in width, with the same result in either case.

(6211) S. S. says: A boat's crew can row 8 miles in 1 hour in still water. What is the rate of the current per hour, if they can row 8 miles up and 8 miles down in 2 hours and 40 minutes? A. Rowing 8 miles per hour against a 5 mile stream equals 3 miles per hour gain, or 8 miles in 2 hours 40 minutes. Rowing at the same rate against an 11 mile current will make the down stream distance of 8 miles in 2 hours and 40 minutes.

(6212) B. F. C.—Dr. F. H. Chittenden, Acting Entomologist, Department of Agriculture, states that the specimen sent is the common bag worm (Thyridopteryx ephemeraeformis). He adds that these worms are protected by a silken pod which is externally covered with bits of plant on which they feed, so that they are not subject so much to the attacks of predaceous insects and birds. There is no better remedy than hand picking where the numbers are not too great to make this feasible. A full, illustrated account of the insect will be found in Bulletin No. 10 of this division.


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## INDEX OF INVENTIONS

**For which Letters Patent of the United States were Granted**

**August 28, 1894,**

**AND EACH BEARING THAT DATE.**

[See note at end of list about copies of these patents.]

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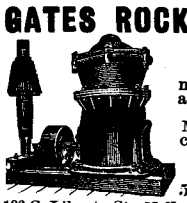
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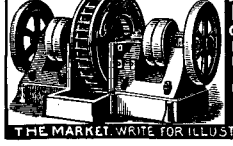
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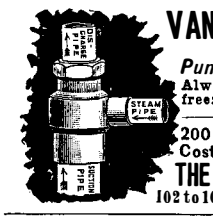
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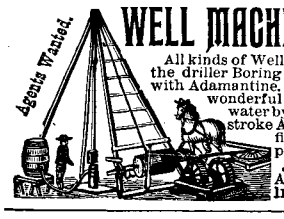

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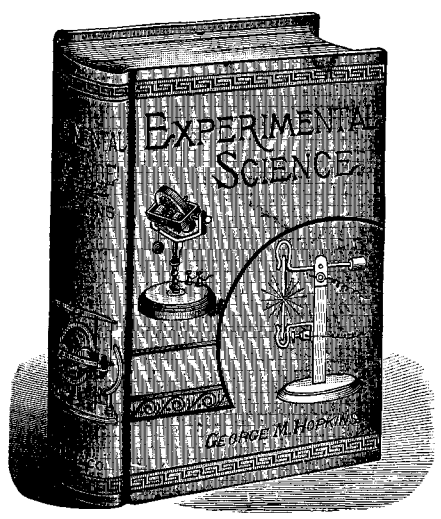

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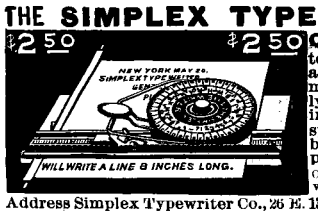


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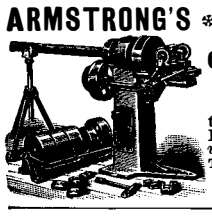

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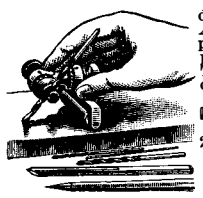

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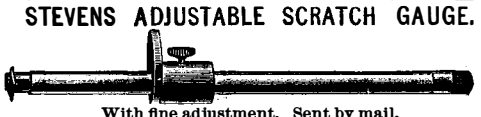

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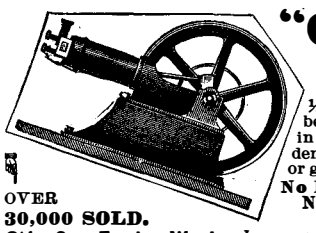

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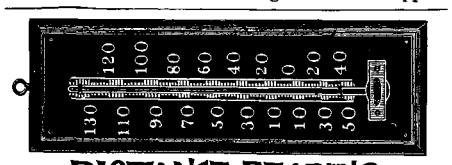


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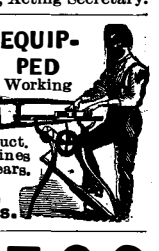

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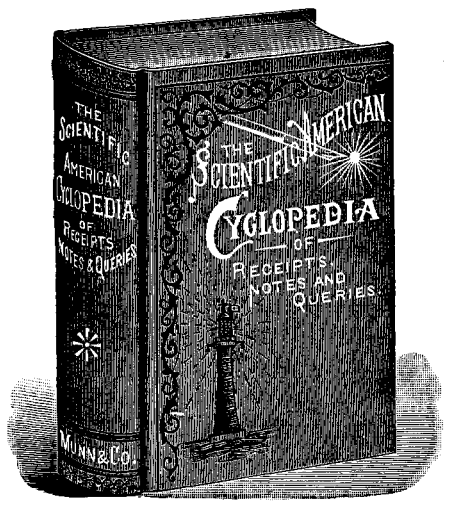


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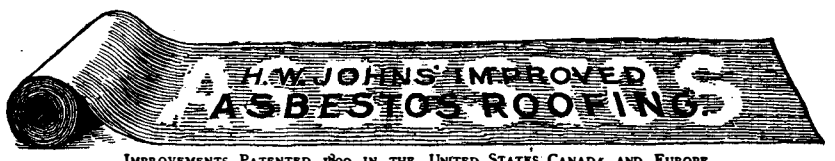


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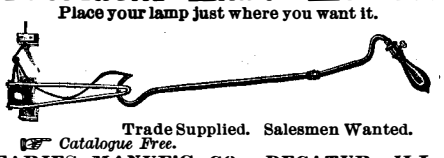

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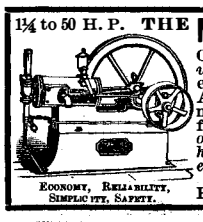


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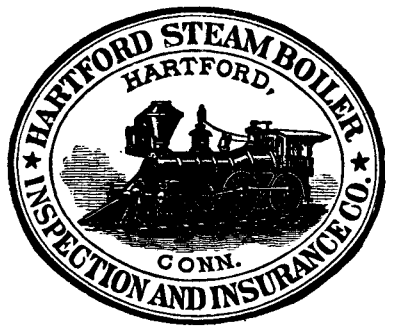


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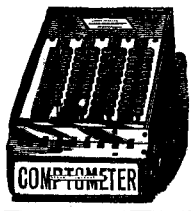


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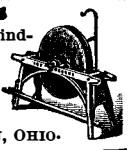

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